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1.

fig. 2.

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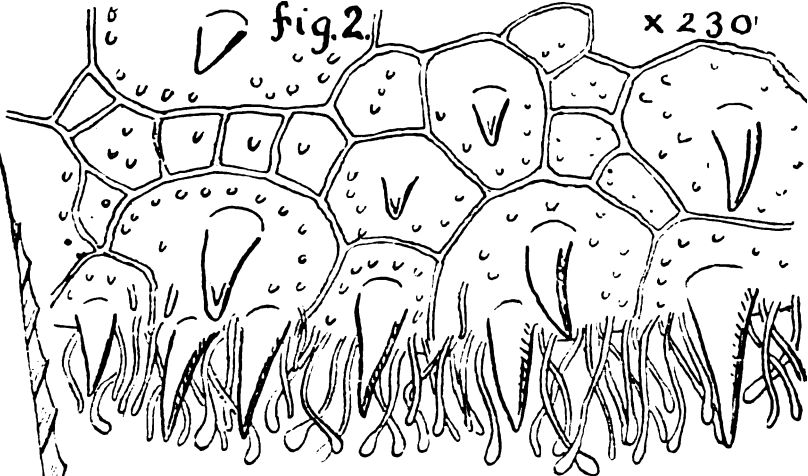


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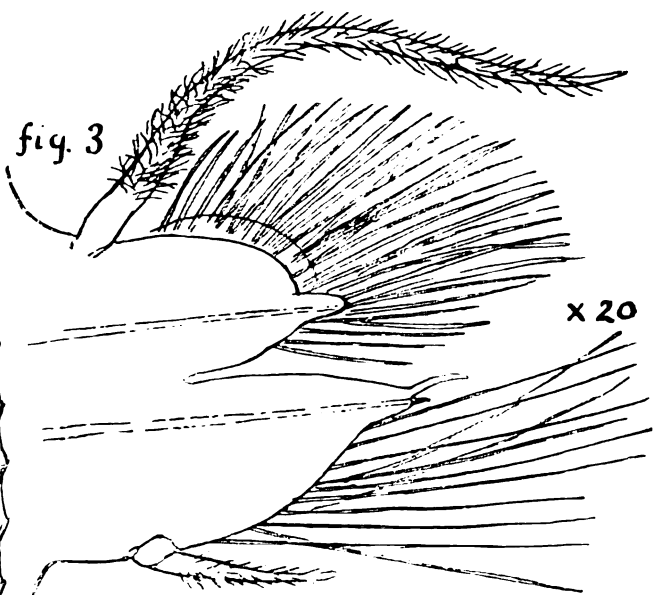


fig. 4

fig. 5



# Proceedings of the United States National Museum

United States National Museum, Smithsonian Institution,  
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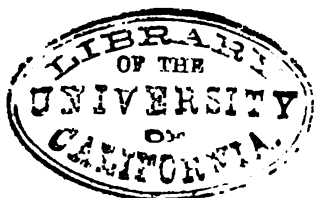
# PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM.

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Volume XIV.



1891.

UNIVERSITY OF  
CALIFORNIA

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## ADVERTISEMENT.

The extension of the scope of the National Museum during the past few years, and the activity of the collectors employed in its interest, have caused a great increase in the amount of material in its possession. Many of the objects gathered are of a novel and important character, and serve to throw a new light upon the study of nature and of man.

The importance to science of prompt publication of descriptions of this material led to the establishment, in 1878, of the present series of publications, entitled "Proceedings of the United States National Museum," the distinguishing peculiarity of which is that the articles are published in pamphlet form as fast as completed and in advance of the bound volume. The present volume constitutes the fourteenth of the series.

The articles in this series consist: First, of papers prepared by the scientific corps of the National Museum; secondly, of papers by others, founded upon the collections in the National Museum; and, finally, of facts and memoranda from the correspondence of the Smithsonian Institution.

The Bulletin of the National Museum, the publication of which was commenced in 1875, consists of elaborate papers based upon the collections of the Museum, reports of expeditions, etc., while the Proceedings facilitate the prompt publication of freshly-acquired facts relating to biology, anthropology and geology, descriptions of restricted groups of animals and plants, the discussion of particular questions relative to the synonymy of species, and the diaries of minor expeditions.

Other papers, of more general popular interest, are printed in the Appendix to the Annual Report.

Papers intended for publication in the Proceedings and Bulletin of the National Museum are referred to the Advisory Committee on Publications, composed as follows: T. H. Bean (chairman), A. Howard Clark, R. E. Earll, Otis T. Mason, Leonhard Stejneger, Frederick W. True, and Lester F. Ward.

S. P. LANGLEY,

*Secretary of the Smithsonian Institution.*

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VOLUME XIV.

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A CATALOGUE OF THE FRESH-WATER FISHES OF SOUTH AMERICA

BY  
CARL H. EIGENMANN AND ROSA S. EIGENMANN.

The present paper is an enumeration of the fishes so far recorded from the streams and lakes of South America, with a few preliminary remarks on the extent, peculiarity, and origin of the fauna and the division of the neotropics into provinces. An attempt has been made to include those marine forms which have been found in the rivers beyond brackish water and to exclude those which probably enter fresh waters, but have not actually been found in any streams. Central American species are not enumerated.

The aim being to present a synopsis of what has been accomplished rather than a list of the species which in our estimation are valid, all the doubtful species are enumerated and the synonyms of each species are given. All the names given to South American fishes prior to 1890 are therefore to be found here.

We have endeavored to adopt and incorporate the results of the latest investigations, chiefly those of Günther, Gill, Cope, Boulenger, Steindachner, and Eigenmann and Eigenmann. Since works of a revisionary character on South American fishes are few, and many of the species have been recorded but once, many changes in the present list will doubtless become necessary. We have critically reviewed about half of the species enumerated. (See bibliography.)

This catalogue was intended to accompany a Catalogue of the Fresh-water Fishes of North America by Dr. D. S. Jordan. Unavoidable circumstances prevented us from completing it as originally planned, and it was thought best to give it the present form. We take pleasure in expressing out thanks to Dr. Theodore Gill for valuable suggestions.

## 2 FRESH-WATER FISHES OF SOUTH AMERICA—EIGENMANN.

### EXTENT OF THE SOUTH AMERICAN FRESH-WATER FAUNA.

There are far more fresh-water fishes in the neotropical than in any other region.<sup>1</sup> Complete enumerations of the fresh-water fishes of other continents are rare, but the following comparison of the latest lists of European and North American fresh-water fishes with a list of the South American species will show the extent of the South American fauna. Those families which are marine, but whose species enter fresh waters, are marked with an asterisk (\*).

Species.		European species.	North American species.	South American species.	General distribution of families.
<b>HYPEROARTIA.</b>					
Lamprey.	* Petromyzontidæ .....	3	8	3	Temperate and arctic regions.
<b>RALE.</b>					
Electric rays.	* Torpedinidæ .....			1	In most seas.
Sting rays.	* Dasybatidæ .....			9	Warm seas.
<b>SELACHOSTOMI.</b>					
Paddlefish.	Polyodontidæ .....		1		North America and Asia.
<b>OLANIOSTOMI.</b>					
Sturgeon.	* Acipenseridæ .....	10	6		Northern.
<b>DIPNOI.</b>					
Lungfishes.	Lepidosirenidæ .....			1	Africa.
<b>GINGLYMODI.</b>					
Gar pike.	Lepidosteidæ .....		3		North American.
<b>HALECOMORPHI.</b>					
Bowfin.	Amiatidæ .....		1		
<b>SYMBRANCHIA.</b>					
	Symbranchidæ .....			1	India.

<sup>1</sup> Heilprin (Distribution of Animals. International Scientific Series D, Appleton & Co., 1887, p. 79) says: "The fresh-water fishes of the Neotropical realm are specifically more numerous than those of any other region, with perhaps the exception of the Holarctic." The Holarctic is defined as follows (p. 56): "The Palæarctic and Nearctic tracts, in the absence of both positive and negative faunal characters of sufficient importance to separate them from each other, are indisputably linked together, and should constitute but a single region (the Holarctic)." Leaving out of consideration all animals but fishes, there are certainly both negative and positive characters to separate the Palæarctic and Nearctic. Mr. Heilprin enumerates the following peculiarities as separating the Nearctic from the Palæarctic: The presence in the Nearctic of *Catostomidæ*, *Centrarchidæ*, *Amiatidæ*, *Lepidosteidæ*. To these should be added the *Hiodontidæ*, *Percopsidæ*, *Amblyopsidæ*, *Aphredoderidæ*, *Elassomatidæ*, and the peculiar development of the *Percidæ*. From an ichthyological standpoint there are certainly positive characters sufficient to separate the Nearctic from the Palæarctic.

Species.		European species.	North American species.	South American species.	General distribution of families.
<b>NEMATOGNATHI.</b>					
Catfish.	Aspredinidæ.....	.....	.....	15	South American.
	Diplomystidæ.....	.....	.....	3	Chilian.
	Siluridæ.....	1	25	199	Cosmopolitan.
	Hypophthalmidæ.....	.....	.....	2	South American.
Mountain catfish.	Pygididæ.....	.....	.....	48	Do.
Do.	Argiidæ.....	.....	.....	8	Do.
Mailed catfish.	Loricariidæ.....	.....	.....	151	Do.
	Callichthyidæ.....	.....	.....	25	Do.
<b>EVENTOGNATHI.</b>					
Sucker.	Catostomidæ.....	.....	51	.....	North American.
Loach.	Cobitidæ.....	3	.....	.....	Asia.
Carp.	Cyprinidæ.....	61	239	.....	Asia, Africa.
Characina.	Characinidæ.....	.....	1	456	Africa.
<b>GYMNOTI.</b>					
Electric eels.	Electrophoridæ.....	.....	.....	1	South American.
	Sternopygidæ.....	.....	.....	30	Do.
<b>ISOSPONDYLI.</b>					
Moon-eye.	Hiodontidæ.....	.....	3	.....	North American.
Herring.	* Clupeidæ.....	2	5	3	All seas.
Gizzard shad.	* Dorosomidæ.....	.....	1	.....	Warm seas.
Big-eyed herring.	* Elopidae.....	.....	1	1	Chiefly in warm seas.
	Osteoglossidæ.....	.....	.....	1	Australia.
	Arapaimidæ.....	.....	.....	1	.....
	* Stolephoridæ.....	.....	.....	8	All warm seas.
	Galaxiidæ.....	.....	.....	5	Tasmania, New Zealand, South America (southern).
		.....	.....	2	Do.
Salmon.	Aplachitoidæ.....	.....	.....	.....	Northern.
Trout perch.	Salmonidæ.....	12	28	.....	.....
	Percoptidæ.....	.....	1	.....	North American.
<b>HAPLOMI.</b>					
Blind fish.	Amblyopsidæ.....	.....	.....	5	North American.
Killifish.	* Cyprinodontidæ.....	3	52	29	Warm seas.
Pike.	Esocidæ.....	.....	1	5	Northern.
Mud minnow.	Umbridæ.....	1	1	.....	.....
<b>XENOMI.</b>					
Blackfish.	Dallidæ.....	.....	1	.....	Alaskan, Siberian.
<b>ENCHELYCEPHALI.</b>					
Eels.	* Anguillidæ.....	2	1	.....	Warm seas.
<b>SYNENTOGNATHI.</b>					
Garfishes.	* Belonidæ.....	.....	.....	5	Warm seas.
<b>HEMIBRANCHII.</b>					
Sticklebacks.	* Gasterosteidæ.....	3	7	.....	Northern.
<b>PERCISOCEI.</b>					
Mullet.	* Mugilidæ.....	.....	.....	3	Warm seas.
Silversides.	* Atherinidæ.....	2	2	3	Do.
<b>PERCOMORPHI.</b>					
Pirate perch.	Polycentridæ.....	.....	.....	3	Northern South America.
	Aphrodoridæ.....	.....	1	.....	North American.
	Elassomatidæ.....	.....	2	.....	Do.
Sunfishes.	Centrarchidæ.....	.....	37	.....	Do.
Perches.	Percidæ.....	11	72	.....	Temperate regions of America and Europe.

Species.		European species.	North American species.	South American species.	General distribution of families.
<b>PERCOMORPHI—continued.</b>					
Sea bass.	* Serranidæ .....	1	4	5	Warm seas
	* Sparidæ .....			1	Do.
Croakers.	* Sciaenidæ .....		1	11	Do.
Cichlids.	* Cichlidæ .....		2	86	Africa, Asia.
Gobies.	* Gobiidæ .....	2	6	15	Warm seas.
Sculpins.	* Cottidæ .....	2	21		Northern.
Toadfish.	* Batrachidæ .....			3	Warm seas.
	* Blenniidæ .....	3			Do.
	* Gadidæ .....	1	1		Northern.
<b>HETEROSOMATA.</b>					
Flounders.	* Pleuronectidæ .....	2	1	10	All seas.
<b>PLECTOGNATHI.</b>					
Puffers.	* Tetraodontidæ .....			1	Warm seas.
Total .....		126	587	1,147	

It will be seen from the preceding list that, even if one or two hundred names are eliminated as probable synonyms, the preponderance of species is still largely in favor of South America. It must also be borne in mind that perhaps not more than two-thirds of the fishes of South America are now known. Many will doubtless not be discovered until there are resident ichthyologists. Only sixty species of fresh-water fishes have been recorded from the large system of the Rio Magdalena. If this number be compared with the forty species taken from Bean Blossom Creek, in Monroe County, Indiana, a small stream not half a dozen yards wide and which was explored along but one mile of its course, the amount of work left undone in the fresh waters of South America may be estimated.

From the American portion of the southern zone,<sup>1</sup> that is, from the whole region south of the La Plata, but eighteen species of fresh-water fishes are known. The headwaters of the La Plata, Magdalena, Orinoco, and of the tributaries of the Amazons and most of the rivers between the Amazon and the San Francisco are, from an ichthyological standpoint, unknown.

Only half of the collections of the Thayer expedition has, as yet, been examined, and many new forms will doubtless be added whenever the remaining portion is studied.

To the number enumerated here should be added the hundred and fifty species of fresh-water fishes recorded from the Mexican and Antillean subregions. The number of known species of neotropical fresh-water fishes is therefore nearly 1,300.

<sup>1</sup> For the limits of this zone, see Günther, "The Study of Fishes," p. 248.

RELATIONS OF THE SOUTH AMERICAN FRESH-WATER FAUNA TO  
THOSE OF OTHER CONTINENTS.

A striking feature of the South American fauna is the presence of marine forms, such as species of *Dasybatidæ*, *Tetraodontidæ*, *Sciaenidæ*, *Batrachidæ*, etc. These, however, ought not here to be considered, although many of their species live exclusively in fresh waters, since the families of which they are representatives inhabit all warm seas.

If these families are left out of consideration it will be seen from the preceding list that there are but three families common to North and South America. The first of these, the *Siluridæ*, is cosmopolitan. The species of *Siluridæ* found in North America belong to the subfamily *Bagrinæ*, while the South American species belong to the subfamilies *Tachisurinæ*, *Callophysinæ*, *Pimelodinæ*, *Doradinæ*, *Auchenipterinæ*, and *Ageneiosinæ*. Of the subfamilies found in South America, those in italics are enneotropic.\* The *Tachisurinæ* are found in all tropical seas, and, for the present purpose, should really be classed with the marine fishes. The *Pimelodinæ* have a few representatives in Africa.

The second and third families, the *Cichlidæ* and *Characinidæ*, have each but one representative extending as far north as Texas.

From the foregoing statements it will be noticed that the South American fauna has little in common and small relationship with the fauna of North America. Central America properly belongs to the South American fauna, while southern Mexico is debatable ground. Several species of *Pimelodinæ*, *Cichlidæ*, and *Characinidæ* occur in southern Mexico. On the other hand, one species of *Bagrinæ*† extends as far south as Guatemala, and another‡ is found on the western slope of central Mexico.§ A species of *Lepidosteus*, an ennearctic genus, has a representative in the western part of Guatemala.

Leaving out of consideration the family *Siluridæ*, which has been discussed above, there remain eighteen truly fresh-water families, eleven of which are enneotropic. Of the remaining seven families two, *Galaxiidæ* and *Aplochitonidæ*, are found only in the Fuegian region, and have representatives in Tasmania and New Zealand. The other five are distributed as follows:

*Lepidosirenidæ* 1 sp.; Africa 2 sp.

*Symbranchidæ* 1 sp.; India 2 sp.

*Characinidæ* 456 sp.; Africa 86 sp.

*Osteoglossidæ* 1 sp.; Australia 1 sp.; East Indian Archipelago 1 sp.

*Cichlidæ* 86 sp.; Africa 29 sp.; India 2 sp.

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\* *Enneotropic*, *ennearctic*, etc., formed like *endemic*, the *en* having the force of "peculiar to."

† *Ictalurus meridionalis* (Günther).

‡ *Ictalurus dugesi* (Beau).

§ *Ictalurus punctatus* (Rafinesque) has been recorded from Surinam. As this species has not been taken during the last 30 years it is perhaps wisest to doubt the correctness of this record.



It will be seen that all but two of the tropical American families not peculiar to America are found in Africa.

There is no species of tropical American fishes known to inhabit any other continent, and but two genera, *Osteoglossum* and *Symbranchus*, are found elsewhere. It is a surprising fact that, although there exists the great similarity between the African and the South American faunas already pointed out, these two genera are not found in Africa. *Symbranchus* inhabits South America and India, *Osteoglossum* South America, Australia, and East Indian Archipelago.\*

We have already called attention to the fact that but one of the South American subfamilies of *Siluridæ* is found elsewhere. The *Pimelodinae* reaches its greatest development in South America (63 species), while in Africa there are but two genera (4 species).

Of the ten subfamilies of the *Characinidæ* four† are enneotropic, three are enafric,‡ and three§ are common to both.

#### THE PECULIARITIES OF THE SOUTH AMERICAN FAUNA.||

As is usual with fresh-water faunas the great majority of South American fishes belong to the Physostomous Teleosts. In the words of Wallace: "Richness combined with isolation is the predominant feature of Neotropical Zoölogy, and no other region can approach it in the number of its peculiar family and generic types."

The families peculiar to South America are: (1) *Diplomystidæ*, (2) *Aspredinidæ*, (3) *Hypophthalmidæ*, (4) *Pygidiidæ*, (5) *Argiidæ*, (6) *Loricariidæ*, (7) *Callichthyidæ*, (8) *Gymnotidæ*, (9) *Sternopygidæ*, (10) *Polycentridæ*. The first seven belong to the degenerate order Nematognathi. The absence of scales, imperfect maxillary, coössified parietals and supraoccipital, the absence of subopercle and coössified anterior vertebrae, distinguish this order. With very few exceptions the species of this order are provided with barbels, which, in some species of *Pimelodinae*, are greatly specialized; being much longer than the whole fish.

The *Diplomystidæ*, of which but a single species is known, is undoubtedly the lowest of the *Nematognathi* and is a remnant of the primitive

\* Perhaps attention should again be called to the *Siluridæ*. The genus *Tachisurus* has representatives in the fresh waters of South America, Africa, and India. It is, however, a marine genus.

† *Erythrininae*, *Curimatinae*, *Anostomatinae*, *Serrasalmoninae*.

‡ *Citharininae*, *Distichodinae*, *Ichthyoborinae*.

§ *Crenuchinae*, *Tetragonopterinae*, *Hydrocyoninae*.

|| We wish to call attention to a fact noticed while studying the Nematognathi. The southern representatives of several genera or even of the same species have not infrequently more rays than the Amazonian forms. All the specimens of *Pseudopimelodus eungaro* recorded from the Amazon have six dorsal rays, while three of the specimens from the south have seven dorsal rays. All the Amazonian species of the genus *Rhamdia* have six dorsal rays, while the southern forms of the same genus frequently have seven or eight; one peculiar to the La Plata has six to nine, and another confined to the San Francisco has ten rays. We have not followed this subject in detail and do not know whether the increase in rays is correlated with an increase of vertebrae.

stock. The maxillary, in this family, bears teeth and forms part of the mouth border. Only two short barbels are present. In all other families of this order the maxillary is vestigiary, its sole function being to serve as a basis for the primary barbel. Through the *Tachisurinae* the *Diplo-mystidae* are very closely related to the *Siluridae*.

Through *Ageneiosus* the *Hypophthalmidae* are closely related to the *Siluridae*.

The *Aspredinidae* are highly specialized and are evidently an early offspring from the common stock.

The *Pygidiidae* are the mountain forms of the *Siluridae*, but have undergone many important modifications.

The *Argiidae* are the mountain forms of the *Loricariidae*.

The *Aspredinidae* are the most specialized of the Nematognathi. The mouth and the air-bladder are greatly modified, while the body is covered with small bony plates.

The *Callichthyidae* are in some sense intermediate between the *Siluridae* and the *Loricariidae*. They have a normal mouth and the body covered with two series of bony plates.

The *Electrophoridae* and *Sternopygidae* constitute the order *Gymnonoti*.

The *Gymnotidae* differ from the *Sternopygidae* in being naked and in possessing an electric organ. The members of both families are long, eel-shaped fishes without a true dorsal fin, without ventral fins, and having a very long anal fin.

None of the *Percomorphi* are peculiarly South American, the only remaining family being the *Polycentridae*, whose position in the system is not definitely determined.

Of the families having a wider distribution, but reaching, in South America, a peculiar development, must be mentioned the marine forms, which, in other regions, do not ascend much beyond brackish water, but which here are found even at a great distance from the sea. Chief of these are the *Dasybatidae*, *Belonidae*, *Mugilidae*, *Sciaenidae*, *Batrachidae*, *Pleuronectidae*, *Tetraodontidae*.

Of especial interest is *Lepidosiren paradoxa*, which represents an ancient order of fishes.

The *Siluridae* here reach their greatest perfection, forty-eight genera of one hundred and ninety-nine species being found in fresh waters, while several species inhabit the surrounding seas. They are generally inhabitants of the low lands. The peculiarities of the *Pimelodinae* are the remote nares, which are not provided with a barbel, and the great development of the maxillary barbels.

The *Callophysinae* are *Pimelodinae* with incisor-like teeth.

The *Doradinae* are provided with a lateral series of bony plates.

The *Ageneiosinae* have a peculiarly modified air-bladder.

The *Auchenipterinae* are very closely related to the *Ageneiosinae*, but possess a normal air-bladder.

The *Characinidæ* also here attain their greatest development. There are sixty-one genera of four hundred and thirty-five species.

The *Erythrininæ* are without an adipose fin.

The *Curimatinae* are edentulous, or have the teeth feebly developed. They differ from the *Citharininae* (African) chiefly in having a shorter dorsal fin.

The *Anostomatinæ* have a short dorsal fin, narrow gill-opening, and remote nares, the teeth being well developed.

The *Tetragonopterinae* and *Hydrocyonina* differ in the character of the teeth, the former having broad notched, the latter conical teeth. The dorsal fin is rather short in both. Both reach their greatest development in South America. There are in South America eighteen genera of one hundred and fifty-nine species of *Tetragonopterinae* and but four genera of twenty-nine species in Africa. Of the *Hydrocyoninae* there are eleven genera of fifty-four species against two genera and five species in Africa.

The *Crenuchinae* consist of two genera of one species each, found respectively in South America and Africa.

The *Serrasalmoninae* are characterized by the large teeth and serrated belly.

The *Cichlidae* is another family which reaches its greatest development in South America.

#### THE ORIGIN OF THE SOUTH AMERICAN FAUNA.

The species of marine families need, in this connection, only a passing notice. Many of the species live habitually in the sea and enter rivers only occasionally. The families having strictly fresh-water species or genera are the *Dasybatidæ*, *Cyprinodontidæ*, *Belonidæ*, *Mugilidæ*, *Serranidæ*, *Sciaenidæ*, *Batrachidæ*, and *Tetraodontidæ*. Some of these, as the genus *Orestias*, are evidently of very long standing. This genus of four species confined to Lake Titicaca was evidently long ago—long before the Andes had reached their present height—separated from the ordinary forms inhabiting brackish water. Other genera belonging to this category are: *Protistius* Cope, a genus intermediate between the *Mugilidæ* and the *Cyprinodontidæ* found in the Peruvian Andes at an elevation of 12,000 feet, and *Gastropterus* Cope (*Mugilidæ*) from the Pacific slope of Peru at an altitude of 7,500 feet.

The genera *Percichthys* and *Percilia* have also been long enough separated from their marine ancestors to become generically distinct.

The fresh-water genera and species of *Belonidæ*, *Sciaenidæ*, *Batrachidæ*, and *Tetraodontidæ* live chiefly in the lower courses of rivers and are probably older additions from the sea.

The *Lepidosirenidæ*, a family of few genera and species, is evidently now in its last stages. No fossils of *Lepidosiren* have yet been found. The Dipnoi made their appearance in the Triassic (Permian; Bohemia, Texas). "Remains of *Ceratodus* have been found throughout the en-

tire series of Mesozoic deposits from the Trias to the Cretaceous, inclusive." Their distribution has evidently become limited in later times and the living members may be looked upon as but remnants of an older fauna.

The number of species of the *Symbranchidæ* is also quite limited, while their geographic range is very large. Nearly all such cases are to be explained by a greater abundance and a wide distribution in former times. The living species enter brackish water, while one genus is strictly marine. Dr. Günther says of this fish (Study of Fishes, p. 226): "The occurrence and wide distribution in Tropical America of a fish of the Indian family *Symbranchidæ*, which is not only congeneric with, but also most closely allied to, the Indian *Symbranchus bengalensis*, offers one of those extraordinary anomalies in the distribution of animals of which no satisfactory explanation can be given at present."

The present is evidently the age of the *Nematognathi* and the *Evenognathi*. Probably all the species of *Nematognathi* of South America are autochthons of that continent. A pretty complete series still exists without taking into account any species of other regions. They are chiefly lower forms, although some of them have reached a high state of specialization in a certain direction. Their evolution has already been discussed by us in various places and it is not necessary to repeat all the considerations here.

The peculiarities of the *Diplomystidæ* have been pointed out above. We must conclude from the presence of dentiferous maxillaries and the absence of all the barbels except the maxillary,\* either that this family represents the ancient *Nematognathi*, or that it is a reversion to the ancient forms. The former conclusion seems preferable. *Siluridæ* have been found in the eocene Tertiary of Europe, while the Wasatch beds, the lowest Tertiary of North America, have yielded several species of a genus (*Rhineastes*) probably related to the *Pimelodinæ*, from which

\* The value placed on the maxillaries can not be questioned, while the value placed on the presence or absence of certain barbels is fully warranted both by the living forms of South America and by the embryology of *Ictalurus albidus* (Le Sueur). Professor Ryder (On the Development of Osseous Fishes, p. 49, Washington, 1886) says: "The remarkably developed barbels of the embryos of this species make their appearance very early, especially the maxillary pair; these appear on the second day. \* \* \* The barbels on the lower jaw do not appear till the fourth day of development is completed. \* \* \* The last of all to be developed is the nasal pair \* \* \* [which] does not appear until the seventh day." Page 54: "Whether the endoskeletal part of the upper end of the so-called maxillary barbel in reality represents the maxillary bone of other fishes seems somewhat open to doubt, as the proximal ossification of the cartilaginous support of this barbel would give this element in the catfishes a cartilaginous origin, which is at variance with what is known of the development of its homologue in all other forms of Teleosts, in which it arises as a membrane bone." At the time of writing this Professor Ryder was probably not familiar with the peculiar Diplomystes.

the present North American forms are, not unlikely, lineal descendants.\*

As the *Silurinae* and *Pimelodinae* were already differentiated near the beginning of the Tertiary, the *Diplomystidae* must have originated still earlier.

The *Tachisurinae* were the first to be differentiated from the *Diplomystidae*. How close the existing intergradation between them may be can not be told from the imperfect knowledge of *Paradiplomystes*, etc. They most probably arose in South America. At present the species are chiefly marine and it is not unlikely that several other subfamilies besides the *Pimelodinae* are directly derived from them.

The *Pimelodinae* are *Tachisurinae* with remote nares. They now flourish most where they probably had their origin. From the *Pimelodinae* have been derived directly or indirectly a number of subfamilies and families. The furthest development in one direction has been reached by the *Aspredinidae*, while the development in the other direction culminates in the *Loricaridae*. There does not seem to exist a sufficient break in the South American series to warrant the supposition that any of the subfamilies were developed elsewhere and have immigrated. They all must be autochthons of the neotropical region.

The *Eventognathi* and *Gymnonoti* form, with the order just considered, the superorder *Ostariophyseæ* of Sagemehl, which is distinguished from all other orders and superorders by the presence of a Weberian apparatus, or *ossicula auditus*, connecting the air bladder with the auditory apparatus. Some of the non-American families of the *Eventognathi* approach so closely to the *Nematognathi* that Valenciennes† had at one time some doubt whether *Pygidium*, a South American genus of *Nematognathi*, should not be placed with the *Cobitidae*. The common descent of the three orders of *Ostariophyseæ* may be conceded. The *Eventognathi* seem to differ from the *Nematognathi* in the possession of a subopercle.

In the north temperate region three families of *Eventognathi* have become differentiated. In the tropics the order is represented by the family *Characinidae*. The subfamilies *Erythrinae*, *Curimatinae*, *Anos-*

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\* Dr. Jordan (Science Sketches, p. 100) says: "The catfishes of [North] America are all probably descendants of a common stock, not allied to South American forms, but probably finding its nearest relatives in India. A single species of this type now exists in China (*Ameiurus cantonensis*); but this is perhaps a returned emigrant from America rather than a direct offshoot of the parent stock. Even before becoming acquainted with Professor Cope's work, "Tertiary Vertebrata," it seemed to us that the *Bagrinae* were derived from the *Pimelodinae*. The presence of a genus of *Tochisurinae* or marine *Pimelodinae* in the North American Tertiary deposits (Dr. Cope was unable to decide which) confirmed my previous notions. The American *Bagrinae* are *Pimelodinae* plus a nasal barbel, the last barbel to be developed. They resemble most the *Pimelodinae* with vomerine teeth, and indeed, the genus *Rhineastes* possesses them.

† See Histoire Naturelle des Poissons, vol. 18, p. 486 (note).

*tomatinae*, and *Serrasalmoninae* are certainly autochthonous of South America and probably later differentiations. The *Tetragonopterinae*, *Hydrocyoninae*, and *Crenuchinae* are, as has been shown under "Relations of the South American Fresh-water Fauna," found both in Africa and South America. No doubt need be entertained about the origin of the genera now found in South America, as they are all peculiar to it. "On the other hand," says Dr. Günther (Study of Fishes, p. 233), "the existence of so many similar forms on both sides of the Atlantic affords much support to the supposition that at a former period the distance between the present Atlantic continents [Africa and South America] was much less, and that the fishes which have diverged towards the east and west are descendants of a common stock which had its home in a region now submerged under some intervening part of the ocean."\* Certain it is that the great preponderance of *Tetragonopterinae* and *Hydrocyoninae* are found in South America, and that there these subfamilies probably had their origin.

Such anomalies as the presence of one species of *Crenuchinae* in South America and another in Africa is at present unexplainable.

The two families of the *Gymnonoti* need few words. They are not, and probably never have been, found outside South America.

The *Osteoglossidae* are probably a family in its last stages.

In the *Galaxiidae* and *Aplochitonidae*, which belong to the south temperate fauna, is seen the wide distribution of genera, and even of species, common in the north temperate region. There seems to be nothing anomalous in their present wide distribution.

The *Polycentridae*, like the *Sternopygidae* and *Electrophoridae* have not been found beyond South America, and they are undoubtedly autochthons.

#### GEOGRAPHICAL DISTRIBUTION.

The distribution of the neotropical fishes presents well nigh all possible conditions. There are species and genera of marine families

\* Wallace says in this connection: "The great continent of South America, as far as we can judge from the remarkable characteristics of its fauna and the vast depth of the oceans east and west of it, has not during Tertiary, and probably not even during Secondary times, been united with any other continent, except through the intervention of North America. \* \* \* What its earlier condition was we can not conjecture, but there are clear indications that it has been broken up into at least three large masses, and probably a number of smaller ones, and these have no doubt undergone successive elevations and subsidences, so as at one time to reduce their area and separate them still more widely from each other, and at another period to unite them into continental masses. The richness and varied development of the old fauna of South America, as still existing, proves, however, that the country has always maintained an extensive area; and there is reason to believe that the last great change has been a long continued and steady increase of its surface, resulting in the formation of the vast alluvial plains of the Amazon, Orinoco, and La Plata, and thus greatly favoring the production of that wealth of specific forms which distinguishes South America above all other parts of our globe."

found in streams and lakes at altitudes of 13,000\* to 15,000 feet, while some Alpine forms descend to the sea.†

Some marine genera have, contrary to *a priori* conceptions, species which are confined to some one river,‡ while species which are strictly fresh-water have unexpectedly wide ranges.§

Many genera of wide distribution are confined to the eastern slopes while genera of narrower distribution|| occur on both sides. Some genera have few species which inhabit neighboring rivers,¶ while the species of some other small genera inhabit widely separated regions.\*\*

The distribution has been discussed by Agassiz, Wallace, Cope, and Günther. Agassiz†† speaks of the distribution of the fishes found on his journey from Para to Tabatinga. His discussions are, however, more valuable as field notes and suggestions than as a contribution to the subject, since he did not consult the works of previous writers. He was especially impressed by the localization of species, which was in great part due to mistaking the variations of a species as distinct species, and to the fact noted above that many of the species supposed by him to be restricted to a peculiar spot had been collected in other localities by other explorers. On page 244 Agassiz says: "To this day I have not yet recovered from my surprise at finding that shores which, from a geographic point of view, must be considered simply as opposite banks of the same stream, were, nevertheless, the abode of an essentially different ichthyological population." This is nothing more than what is to be observed at a given locality of many rivers or along most coasts. At Wood's Holl, Massachusetts, or at San Diego, California, for instance, different species inhabit restricted areas within a few square miles, one set of species rarely entering the locality of the other. For this reason some species are always associated with certain other species. The same holds good of rivers and creeks. In a small stream in Indiana the numerous species of darters are found at one point; half a mile further on are species of *Noturus*, beyond which are species of *Amiurus*, etc. To Professor Agassiz, however, belongs the credit of first calling attention to this fact.

Wallace‡‡ devotes but little attention to fresh-water fishes, summarizing the accounts in Dr. Günther's Catalogue of Fishes.

\* *Orestias* (*Cyprinodontidae*), *Gastropterus*, *Protistius* (*Mugilidae*).

† *Pygidium pardum* (*Pygididae*) in Callao Bay.

‡ *Tachisurus grandoculis* in the Rio Doce.

§ *Callichthys callichthys*; *Hoplosternum littorale*, etc., La Plata to Trinidad; *Pimelodus olarias*, etc., La Plata to Rio Magdalena.

|| *Cetopsis*.

¶ *Steindachneria* with three species: (1) *amblyura* in the Jequitinhonha; (2) *doceana* in the Rio Doce; (3) *parahybæ* in the Rio Parahybæ.

\*\* *Stegophilus* with six species: (1) *maculatus* in the La Plata; (2) *punctatus* at Canelos, Ecuador; (3) *intermedius* at Goyaz; (4) *macrops* at Manacapurn; (5) *insidiosus* in the Rio das Velhas; (6) *reinhardtii* in the Solimões and its tributaries.

†† A journey in Brazil. Boston: Ticknor & Fields, 1868.

‡‡ The Geographical Distribution of Animals. Harper & Bros.: New York, 1876.

Dr. Günther<sup>1</sup> treats of the distribution of South American fishes more in general. He divides South America into the neotropical region and the Fuegian subregion, separated by a line from the tropic "until it strikes the western slope of the Andes \* \* \* where it again bends southwards to embrace the system of the Rio de la Plata." Leaving out of consideration all the marine forms entering or inhabiting rivers, he enumerates 672 fresh-water fishes in the whole of the neotropical region, including Mexico and the West Indies. This subdivision of the South American portion of the neotropics is a natural one as far as fishes are concerned, and it is adopted here.

Before discussing the subregions, provinces, etc., more in detail, we present the following lists of genera peculiar to the different localities. Since almost all genera are here accounted for, it will be seen that South America is divided into well-defined provinces.

## I.

Genera peculiar to Chili, Patagonia, Argentine Republic, and Terra del Fuego:

- |   |   |
|---|---|
| 1. <i>Diplomystes</i> .....1 sp., Chili | 3. <i>Percichthys</i> .4 sp., Chili and Patagonia |
| 2. <i>Nematogenys</i> .....1 sp., Chili | 4. <i>Percilia</i> .....1 sp., Chili              |
- (*Petromyzontidæ*.)

These genera, four in number, are the only ones inhabiting the large Fuegian subregion of the southern zone which are not also found in the Brazilian subregion. Several genera of wide distribution, especially *Pygidium*, have representatives here.

The following lists, exclusive of XVII and XVIII, characterize the Brazilian subregion. A few of the genera have also representatives in the Mexican subregion.

## II.

Genera with representatives in all or nearly all the rivers from the La Plata to the Magdalena. Those having representatives on the western slopes are marked with an asterisk (\*), those not yet recorded from the La Plata are marked with a dagger (†), those not yet found in the Rio Magdalena are marked with a double dagger (‡):

- |   |                                      |
|---|--------------------------------------|
| 1. <i>Pseudopimelodus</i> .....6 sp.      | 10. <i>Rhinelepis</i> .....3 sp.     |
| 2. <i>Rhamdia</i> * .....22 sp.           | 11. <i>Callichthys</i> † .....2 sp.  |
| 3. <i>Pimelodella</i> .....12 sp.         | Described as 11 species.             |
| 4. <i>Pimelodus</i> .....13 sp.           | 12. <i>Hoplosternum</i> ‡ .....3 sp. |
| 5. <i>Trachycorystes</i> † .....13 sp.    | Described as 13 species.             |
| 6. <i>Pseudauchenipterus</i> † .....4 sp. | 13. <i>Corydoras</i> .....12 sp.     |
| 7. <i>Ageneiosus</i> .....12 sp.          | 14. <i>Macrodon</i> .....2 sp.       |
| 8. <i>Loricaria</i> .....34 sp.           | Described as 12 species.             |
| 9. <i>Plecostomus</i> * .....28 sp.       | 15. <i>Erythrinus</i> .....4 sp.     |

<sup>1</sup> The Study of Fishes. Black: Edinburgh, 1880.



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16. <i>Curimatus</i> * ..... 44 sp. and var.	21. <i>Brycon</i> * ..... 34 sp.
17. <i>Prochilodus</i> * ..... 22 sp.	22. <i>Xiphorhamphus</i> ..... 12 sp.
18. <i>Leporinus</i> ..... 28 sp.	23. <i>Astronotus</i> ..... 38 sp.
19. <i>Tetragonopterus</i> * ..... 71 sp.	Many species in Central America and Mexico.
Sixteen other species in Central America to United States.	24. <i>Crenicichla</i> * ..... 27 sp.
20. <i>Cheirodon</i> * ..... 9 sp.	25. <i>Geophagus</i> * ..... 22 sp.

Average number of species to each genus, 15+.

### III.

Genera having representatives in the rivers from the La Plata to the Rio Magdalena, exclusive of those of southeastern Brazil. Those not yet recorded from the Magdalena marked with an asterisk (\*):

1. <i>Pseudoplatystoma</i> .... 7 sp. and var.	12. <i>Chalcinus</i> ..... 9 sp.
2. <i>Platystoma</i> ..... 1 sp.	13. <i>Gasteropelecus</i> * ..... 4 sp.
3. <i>Doras</i> ..... 24 sp.	14. <i>Raeboides</i> ..... 8 sp.
4. <i>Oxydoras</i> ..... 4 sp.	15. <i>Cynopotomus</i> ..... 7 sp.
5. <i>Stegophilus</i> ..... 6 sp.	16. <i>Pygocentrus</i> ..... 7 sp.
6. <i>Hemiancistrus</i> ..... 17 sp.	17. <i>Serrasalmo</i> ..... 14 sp.
7. <i>Ancistrus</i> ..... 8 sp.	18. <i>Myletes</i> * ..... 31 sp.
9. <i>Hemiodus</i> <sup>1</sup> ..... 10 sp.	19. <i>Sternarchus</i> * ..... 9 sp.
10. <i>Parodon</i> <sup>2</sup> ..... 3 sp.	20. <i>Sternopygus</i> ..... 6 sp.
11. <i>Anostomus</i> * ..... 10 sp.	21. <i>Caraprus</i> ..... 1 sp. (described as 7.)

Average number of species to each genus, 9.25.

### IV.

Genera with representatives on both slopes of the Andes:

1. <i>Rhamdia</i> <sup>3</sup> ..... 22 sp.	8. <i>Macrodon</i> ..... 2 sp.
2. <i>Pimelodella</i> <sup>4</sup> ..... 12 sp.	9. <i>Curimatus</i> <sup>9</sup> ..... 43 sp. and vars.
3. <i>Cetopsis</i> <sup>5</sup> ..... 6 sp.	10. <i>Tetragonopterus</i> <sup>10</sup> ..... 71 sp.
4. <i>Pygidium</i> <sup>6</sup> ..... 25 sp.	(Others in Central America, etc.)
5. <i>Loricaria</i> <sup>7</sup> ..... 34 sp.	11. <i>Cheirodon</i> <sup>11</sup> ..... 9 sp.
6. <i>Plecostomus</i> <sup>8</sup> ..... 25 sp. and var.	12. <i>Brycon</i> <sup>12</sup> ..... 34 sp.
7. <i>Chaetostomus</i> ..... 20 sp.	Two additional sp. in Central America.

Average number of species to each genus, 25½.

<sup>1</sup> *H. unimaculatus* in the Cujaba.

<sup>2</sup> Only in the La Plata, San Francisco and Amazonas.

<sup>3</sup> *Cinerascoens* Guayaquil; Esmeraldas. *Wagneri*, east and west slopes of Panama.

<sup>4</sup> *Modestus*, western Ecuador, eastern Panama; *elongatus*, western Ecuador.

<sup>5</sup> *Occidentalis*, Guayaquil.

<sup>6</sup> Many species; Alpine forms.

<sup>7</sup> Several species at Panama, both eastern and western slopes.

<sup>8</sup> *Spinosissimus*, Guayaquil.

<sup>9</sup> *Troschellii*, Guayaquil; western Andes of Ecuador.

<sup>10</sup> *Brevirostris*, western Andes of Ecuador; *microphthalmus*, Rio Rimac; *polyodon*, Guayaquil.

<sup>11</sup> *Pisciculus*, Santiago, Chili.

<sup>12</sup> *Atricanatus*, western Andes of Ecuador.

## V.

Genera peculiar to the western slopes of Peru, Ecuador, and Colombia:

1. Lebiasina .....	1 sp.	3. Pseudochalcens .....	1 sp.
2. Saccodon .....	2 sp.	4. Gastropterus .....	1 sp.

Average number of species to each genus, 1.25.

## VI.

Genera peculiar to the Amazons and the region to the north of them, especially the Guianas. Those marked with an asterisk (\*) have representatives in the Rio San Francisco:

1. Bunocephalus .....	7 sp.	24. Anacyrtus .....	6 sp.
2. Aspredo .....	6 sp.	25. Rostes .....	2 sp.
3. Callophysus .....	1 sp.	One species in Guatemala.	
4. Phractocephalus .....	1 sp.	26. Exodon .....	1 sp.
5. Sorubimichthys .....	3 sp.	27. Xiphostoma .....	6 sp.
6. Hemidoris* .....	13 sp.	28. Hydrolycus .....	4 sp.
7. Trachelyopterus .....	2 sp.	29. Cynodon .....	2 sp.
8. Centromochlus .....	5 sp.	30. Crenuchus .....	1 sp.
9. Auchenipterus .....	3 sp.	31. Mylesinus .....	1 sp.
10. Hypophthalmus .....	1 sp.	Boundaries of distribution not well defined.	
11. Farlowella .....	6 sp.	32. Pygopristis .....	2 sp.
12. Hypoptopoma .....	3 sp.	33. Electrophorus .....	1 sp.
13. Panaque .....	3 sp.	Southern boundaries not well defined.	
14. Pterygoplichthys* .....	8 sp.	34. Rhamphosternarchus .....	5 sp.
15. Pyrrhulina .....	9 sp.	35. Rhamphichthys .....	3 sp.
16. Chilodus .....	2 sp.	36. Brachyrhamphichthys .....	5 sp.
17. Nannostomus .....	5 sp.	37. Osteoglossum .....	1 sp.
18. Piabucina .....	4 sp.	38. Potamorhaphis .....	1 sp.
19. Odontostilbe .....	2 sp.	39. Plagioscion .....	4 sp.
20. Chalceus .....	2 sp.	40. Cichla .....	4 sp.
21. Creatochanes .....	3 sp.	41. Chaetobranchus .....	4 sp.
22. Creagrutus* .....	4 sp.	42. Colomesus .....	1 sp.
Upper courses of rivers.			
23. Piabuca .....	2 sp.		

Average number of species to each genus, 3.5.

## VII.

Genera peculiar to the Amazons (Amazon, Solimoens, Marañon) and their tributaries.

Those genera found in but two of the rivers are included here:

1. Lepidosiren .....	1 sp.	7. Vandellia .....	2 sp.
2. Piramutana .....	1 sp.	8. Pareiodon .....	2 sp.
3. Platinemichthys .....	2 sp.	9. Hemiodontichthys .....	1 sp.
4. Sciades .....	2 sp.	10. Parancistrus .....	3 sp.
5. Auchenipterichthys .....	2 sp.	11. Acanthicus .....	3 sp.
6. Epapterus .....	2 sp.	12. Decapogon .....	1 sp.

13. <i>Læmolyta</i> * .....	1 sp.	19. <i>Mesonauta</i> .....	1 sp.
14. <i>Anodus</i> .....	3 sp.	20. <i>Crenicara</i> .....	1 sp.
15. <i>Potamorhina</i> .....	1 sp.	21. <i>Dicrossus</i> .....	1 sp.
16. <i>Bryconops</i> .....	2 sp.	22. <i>Uaru</i> .....	3 sp.
17. <i>Stethaprion</i> .....	3 sp.	23. <i>Astronotus</i> .....	3 sp.
18. <i>Monocirrhus</i> .....	1 sp.	24. <i>Symphysodon</i> .....	1 sp.

*Pterophyllum* 1 sp.

Average number of species to each genus about  $1\frac{3}{4}$ .

## VIII.

Genera peculiar to the Amazon and its tributaries, including the Rio Negro :

1. <i>Elipesurus</i> .....	1 sp.	4. <i>Platystomatichthys</i> .....	1 sp.
2. <i>Bunocephalichthys</i> .....	1 sp.	5. <i>Oxyropsis</i> .....	1 sp.
3. <i>Pimelodina</i> .....	2 sp.	6. <i>Rhytiodus</i> .....	2 sp.

Average number of species to each genus,  $1\frac{1}{2}$ .

## IX.

Genera peculiar to the Solimoes and its tributaries :

1. <i>Nemuroglanis</i> .....	1 sp.	4. <i>Miuroglanis</i> .....	1 sp.
2. <i>Trachelyopterichthys</i> .....	1 sp.	5. <i>Chaetobranchopsis</i> .....	1 sp.
3. <i>Tridens</i> .....	2 sp.	6. <i>Saraca</i> .....	1 sp.

Average number of species to each genus,  $1\frac{1}{2}$ .

## X.

Genera peculiar to the Marañon and its tributaries .

1. <i>Dysichthys</i> .....	1 sp.	6. <i>Brochis</i> .....	4 sp. of 2 subgenera.
2. <i>Nannoglanis</i> .....	1 sp.	7. <i>Plethodectes</i> .....	1 sp.
3. <i>Physopyxis</i> .....	1 sp.	8. <i>Iguanodectes</i> .....	1 sp.
4. <i>Stegophiloides</i> .....	1 sp.	9. <i>Aphiocharax</i> .....	3 sp.
5. <i>Dianema</i> .....	1 sp.	10. <i>Metynnis</i> .....	1 sp.

Average number of species to each genus, 1.5.

## XI.

Genera peculiar to the Guianas :†

1. <i>Hologenes</i> .....	1 sp.	4. <i>Anableps</i> .....	1 sp.
2. <i>Agoniatus</i> .....	1 sp.	One sp. in Guatemala.	
3. <i>Catoprion</i> .....	1 sp.	5. <i>Polycentrus</i> .....	2 sp.

Average number of species to each genus,  $1\frac{1}{2}$ .

## XII.

Genera peculiar to the Rio Magdalena :

1. <i>Eremophilus</i> .....	1 sp.	3. <i>Luciocharax</i> .....	1 sp.
2. <i>Astroblepus</i> .....	1 sp.	(Found also in the Mamoni River.)	

\* Since this was written it has been found that *Læmolyta* occurs also in the Orinoco and contains 4 species.

† *Stevardia* of four species in Trinidad.

## XIII.

Genera peculiar to the San Francisco and its tributaries:

1. *Bagropsis* ..... 1 sp. | 2. *Duopalatinus* ..... 1 sp.

## XIV.

Genera peculiar to the rivers of southeastern Brazil, between the Rio San Francisco and the La Plata, but exclusive of those rivers:

Genera.		Distribution.
1. <i>Steindachneria</i> .....	3 sp.	Parahyba; Doce; Jequitinhonha.
2. <i>Wertheimeria</i> .....	1 sp.	Jequitinhonha.
3. <i>Harttia</i> .....	1 sp.	
4. <i>Hisonotus</i> .....	1 sp.	Parahyba; Santa Cruz.
5. <i>Parotocinclus</i> .....	1 sp.	Santa Cruz.
6. <i>Delturus</i> .....	2 sp.	Rio Mucuri; Rio Parahyba.
7. <i>Hemipsilichthys</i> .....	1 sp.	Rio Parahyba.
8. <i>Scleromystax</i> .....	1 sp.	Rio Janeiro.
9. <i>Henochilus</i> .....	1 sp.	Rio Mucuri.

Average number of species to each genus,  $1\frac{1}{3}+$ .

## XV.

Genera peculiar to the high Andes of Peru, Ecuador, and Colombia:

1. *Arges*..... 4 sp. | 3. *Orestias*..... 4 sp.  
2. *Cyclopium*..... 2 sp. | 4. *Gastropterus*..... 1 sp.  
5. *Protistius*, 1 sp.

Average number of species to each genus, 2.6.

## XVI.

Genera peculiar to the La Plata and its tributaries:

1. *Cochlodon*, 1 sp.

## XVII.

Genera of wide distribution. The lists to which they are most nearly related are indicated by Roman numerals:

Genera.		Distribution.
II. <i>Rhamdella</i> .....	8 sp. or more.	Southeastern Brazil; Amazon; Central America.
II. <i>Chatostomus</i> .....	20 sp.	Chiefly in upper courses of rivers.
II. <i>Pygidium</i> .....	25 sp.	Chiefly in mountainous regions.
II. <i>Characidium</i> .....	4 sp.	Parahyba to Orinoco; Marañon.
VII. <i>Leporellus</i> .....	1 sp.	Rio das Velhas; Amazons; Cauca.
VII. <i>Paragoniatus</i> .....	3 sp.	Amazons; Rio Janeiro.
III. <i>Salminus</i> .....	5 sp.	La Plata; San Francisco; Jacuhy; Cauca.
VI. <i>Arapaima</i> .....	1 sp.	Bahia; Amazons and northward.
I. <i>Galaxias</i> .....	5 sp.	Falkland Islands; Terra del Fuego; (Andes of Peru ?).
I. <i>Aplochiton</i> .....	2 sp.	Terra del Fuego; Falkland Islands.
III. <i>Pachyurus</i> .....	4 sp.	San Francisco; La Plata; Amazons.

Average number of species to each genus, 7+.

## XVIII.

Genera peculiar to Central America and Mexico. Those marked with an asterisk (\*) are immigrants from North America, where they are still abundant:

1. <i>Lepidosteus</i> *	1 sp.	8. <i>Belonesox</i> .....	1 sp.
2. <i>Amiurus</i> *	1 sp.	9. <i>Mollienisia</i> .....	
3. <i>Ictalurus</i> *	1 sp.	10. <i>Xiphophorus</i> .....	1 sp.
4. <i>Dorosoma</i> *	1 sp.	11. <i>Platyæcilus</i> .....	1 sp.
5. <i>Characodon</i> .....	2 sp.	12. <i>Agonostomus</i> .....	3 sp.
6. <i>Girardinichthys</i> .....	1 sp.	13. <i>Chirostoma</i> .....	2 sp.
7. <i>Pseudoxiphophorus</i> .....	2 sp.	14. <i>Neotroplus</i> .....	1 sp.

The foregoing lists explain themselves in part, but a few remarks will not be altogether out of place. It will be seen that genera of many species usually have a wide distribution, and, conversely, genera of wide distribution usually have many species. A comparison of Lists II, III, IV, and XVI on the one hand, with Lists VII, VIII, IX, etc., and even VI, on the other, will show this in a striking manner. In List II, for instance, of the genera found distributed over the whole of the Brazilian subregion, each genus has at an average 15 species. In List III, whose genera have but a slightly more restricted distribution, each genus is composed of  $9\frac{1}{2}$  species, at an average. In List VI, whose genera, while they have a wide distribution, are yet much more restricted than in the others mentioned, each genus has, on an average, but  $3\frac{1}{2}$  species. The genera of List VII have on an average, but  $1\frac{3}{4}$  species, and those of List VIII but 1. The number of species of each genus, therefore, varies directly as the extent of its distribution, and, conversely, the extent of the distribution of any genus varies directly as the number of species composing it.

There are a few genera which do not come under this general proposition. *Callichthys* has but two species, and *Hoplosternum* only three, but the limits of variations of the species of these two genera are so wide that the two species of *Callichthys* have received eleven different names, and the three of *Hoplosternum* thirteen. The most noted exception to the first half of the proposition is *Hemidoras* (List VI), with thirteen species.

At a first glance it might appear that a genus with a narrow distribution must necessarily, on account of its restriction, have few species, but a closer inspection will show that this is not the case. Taking, for instance, Lists II and VII: The genus *Pseudopimelodus* has four representatives in the region covered by VII; the genus *Rhamdia* twelve; *Pimelodella* five; *Pimelodus* seven; *Trachycorystes* five; *Pseudoucheiapterus* two; *Ageneiosus* six; *Loricaria* nineteen, etc. This shows that the genera of wide distribution have, on average, several times as many species in a given system, even if it be as large as that of the Amazons, as a genus restricted to this system; and that a genus of narrow distribution has not a small number of species simply because there is room for no more.

The explanation is probably connected with the age of any given genus. Those genera with many species and wide distribution are evidently now at their prime, while those with wide distribution and few species, occupying isolate places are probably remnants from another age, and genera with few species and narrow distribution are very probably later differentiations. There are, of course, cases which will not be classified thus. *Callichthys* and *Hoplosternum* are cases in hand which have already been mentioned. *Platystoma* (List III) offers another instance, being composed of a single species distributed over nearly the whole of the region east of the Andes and north of Buenos Ayres.

Another fact worthy of mention, though not directly illustrated by these lists, is that the species of wide distribution belong to genera of many species and wide distribution. Genera of many species frequently have one or more species of wide distribution. On the other hand genera of few species and narrow distribution usually have species of restricted distribution.

The variability of species of wide distribution has already been mentioned.

We shall now take up the zoögeography more in detail. Too great stress must not be placed on our present knowledge; the details of the distribution of not one species is as yet worked out. The absence of certain genera from the Rio Magdalena and the Rio Plata is probably due to our lack of knowledge. The general results, however, will perhaps not vary greatly from what may be deduced from the present data.

A word as to the preparation of the lists. The entire catalogue was read and the genera (exclusive of marine) having similar geographical boundaries were placed together, the result obtained being presented in the foregoing lists. The regions covered by each list are, therefore, the necessary outcome of the facts. There are, naturally, a number of genera which can not be placed in any of the lists.

The first list gives the genera characterizing the Fuegian subregion of the southern zone. Although a few genera (*Chirodon*, *Pygidium*) have representatives here, its fauna is such as to separate it very distinctly from the neotropical realm and it is included here more for convenience than for its affinity with the rest of South America.

The second list, and the third and fourth with the exception of those genera found also in the Mexican subregion and so marked, present the genera which characterize the Brazilian subregion as a whole. A few of the genera have not been found in the Rio Plata and the Rio Magdalena.

The fifth list characterizes what may be termed the Pacific province of the Brazilian region. It includes the territory west of the Andes, between Costa Rica\* and Peru.

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\* The Rio Chagres certainly does not belong to the Mexican subregion.

The validity of this province, as of all the others considered here, will become much more apparent if the number of peculiar species of other than peculiar genera (see List IV, foot-notes) are taken into account. Omitting alpine forms, such as *Pygidium*, the species, with few exceptions, are peculiar—the few excepted species being inhabitants of Central America, from where they have very probably emigrated. As several forms are now found on both the eastern and western slopes of Panama, the isthmus does not seem to be a barrier to the migration of fresh-water fishes at present, and many of the lowland species of eastern genera now inhabiting this province may, within comparatively recent time, have been derived from the east by way of Panama. That the mountains of Panama are a greater barrier than the ocean is clearly seen by noting the species found in the Rio Magdalena which are also found in some of the other eastern slope streams, but are not found in the Pacific province.

List VI would indicate that the Amazons and the region to the northward constitute a well marked subregion or a province. The validity of this province seems doubtful in the face of this seeming preponderance of evidence. The greater portion of the Paraña and Paraguay are unexplored, and it is tolerably safe to predict that many of the genera enumerated as peculiar to this province will be found in some portion of the La Plata system. The explorations of Natterer in the Cujaba fully warrant such a forecast. He found several Amazonian genera in this river which had not before been recorded from the La Plata system, many of which have not again been taken in its lower courses. Dr. D. S. Jordan\* has lately called attention to the fact mentioned many years ago by Robert Schomburgk, that there is at times a connection between the Amazon and La Plata systems. Dr. Jordan says: "Prof. John C. Branner calls my attention to a marshy upland which separates the valley of the La Plata from that of the Amazon, and which permits the free movement of fishes from the Paraguay River to the Tapajos. It is well known that through the Cassiquiare River the Rio Negro, another branch of the Amazon, is joined to the Orinoco River. It is thus evident that almost all the waters of eastern South America form a single basin, so far as fishes are concerned."<sup>†</sup>

The large number of genera found in the Amazons and La Plata which do not occur in the rivers of southeastern Brazil (see List III) would lead one to conclude that the Amazonian genera reach the La Plata system directly, even if such connections as are known to exist were not known.

\* Science Sketches, 120, foot-note 1.

† The American Naturalist of April, 1888, contains the following: "M. Chaffanjon, the well known explorer of the Orinoco, has carefully studied the communication between that river and the Amazon, by means of the Cassiquiare, and comes to the conclusion that it is of recent origin. The rapid current of the Orinoco, as it passes through a gorge only 90 yards wide in the clay deposits, undermines the banks, and this action, combined with actual overflow in the rainy season, has produced a permanent channel. The clay deposits on the left bank have a slope towards the Amazon.

The Guianas present more faunal similarity to the Amazons than to the Orinoco, notwithstanding the fact that a direct connection between the Rio Negro and Cassiquiare exists. The anomaly may be explained by the comparative state of knowledge of the Orinoco and the Guianas, the former having received but little attention from explorers, while the Guianas—especially British Guiana—have been pretty well searched by many naturalists.

The genera of the Amazons (Lists VII, VIII, IX, X) are sufficient in number to warrant the separation of the Amazons, exclusive of the high mountain sources, as a distinct province, the Amazonian province. This province ought probably to include the Orinoco. As a convenience the genera are separated into four divisions, but many of Lists VIII to X will certainly be placed under the head of VII when the geographical limits become better known. Many of the genera enumerated under VII are known from only two portions of the large system, some being from the Amazon and Solimoes, others from the Solimoes and Marañon, and others from the Amazon and Marañon. The last combinations are again to be explained by our comparative lack of knowledge of the Solimoes fauna. There are also genera (as *Mesonauta*) found in the Amazon and the Guaporé under conditions which differ more than those between the Amazon and the Marañon. For the present, then, the whole of the Amazon basin may be considered as one province. The Amazon fauna presents many similarities to the Guiana fauna.

Lists XI to XIII show in a striking manner the paucity of peculiar generic types in the San Francisco, Guianas, and Magdalena regions and their *entire absence* in the Orinoco region. The comparatively large number of genera peculiar to the Guianas is doubtless due to the large number of isolated river systems which are yet too closely united to warrant a separation into distinct provinces. The absence of peculiar generic types in the Orinoco is probably due to our meager knowledge of that large river and to its direct connection with the Amazons.

The Rio Magdalena, considering its isolation and the fact that it lies entirely to the west of one of the highest northern Andean ridges, has remarkably few generic types peculiar to itself as well as a strikingly large number of species found in other eastern rivers. If we compare this with the paucity of identical types in the Pacific province and in the eastern provinces we have before us a self-evident proof that, within a certain limit, bodies of salt water present a much weaker barrier to the distribution of fresh-water fishes of South America than even a narrow and comparatively low mountain chain such as separates the Cauca from the Pacific province.

The Rio San Francisco has but two peculiar genera which are very closely related to genera of wide distribution. This can not be attributed to lack of knowledge, for, through the labors of Reinhardt, Lütken, and others, this river fauna has been as well made known as that of any other region. As will be seen from List VI, this river has several genera



found elsewhere only in the Amazons and northward. These are very probably late immigrants from the Amazon. This system may provisionally be set apart as the San Francisco province.

South of the Rio San Francisco is a province well marked both positively and negatively. Very many genera found to the north and to the south (see List III) have no representatives here, while a large number of genera are peculiar to the region. Its northern and southern limits can not yet be defined; roughly speaking, it includes all the Atlantic slopes of Minas Geraes, Bahia, and Rio de Janeiro. The chief river, and the one most thoroughly explored, is the Parahyba with its tributaries Muriahé and Rio Preto. Other rivers are the Itabapuauna, Doce, Mucuri, Jequitinhonha, Pardo, Paraguassu.

The isolation of this province proves in a very decided manner that the large number of genera of the La Plata which are also found in the Amazons have not reached the La Plata by way of the sea. The region may be termed the Atlantic province.

The mountain streams of Colombia, Ecuador, Peru, and Bolivia are inhabited by a number of peculiar genera (xv) and a large number of peculiar species, especially of *Pygidium* and *Chaetostomus*. The peculiarities are such that these mountain regions may readily be distinctly separated as the Andean province. The genera *Eremophilus* and *Astroblepus* ascribed to the Magdalena may belong to this province. Its boundaries are necessarily very irregular and as yet not well defined. Species of *Pygidium*, which are here especially abundant, are also found in the coast rivers of Peru and southward to Chili, thus forming an important portion of the Fuegian fauna. The most important body of water is Lake Titicaca and the headwaters of both the eastern and western slopes are included.

Of the La Plata province little need be said at this time. A very large part of it has not yet been explored. At present the province must be distinguished by its negative characters. The genus *Cochliodon* is so nearly related to Amazonian genera that it is of no great importance. The way in which Amazonian genera may enter the La Plata system has been pointed out above.

With the present data the Brazilian subregion may provisionally be divided into the following provinces: (1) Pacific, (2) Andean, (3) Magdalena, (4) Orinoco, (5) Guiana, (6) Amazonian, (7) San Franciscan, (8) Atlantic, (9) La Plata.

This account would not be complete without a few words in regard to Central America and Mexico. The latter may be dismissed with the statement that its northern half contains North American forms chiefly while its southern half has a large proportion of Central American forms. The Central American fauna consists of very few northern types, the great majority being modified representatives of South American forms. There does not exist at present a sufficient barrier to pre-

vent the ready intermingling of the two faunas. Wallace says on this subject:

The whole character of neotropical zoölogy, whether as regards its deficiencies or its specialties, points to a long continuance of isolation from the rest of the world, with a few very distant periods of union with the northern continent. The latest important separation took place by the submergence of parts of Nicaragua and Honduras, and this separation probably continued throughout much of the Miocene and Pliocene periods; but some time previous to the coming on of the glacial epoch, the union between the two continents took place which has continued to our day. Earlier submergences of the Isthmus of Panama probably occurred, isolating Costa Rica and Veragua, which then may have had a greater extension, and have thus been able to develop their rich and peculiar fauna.

The Isthmus of Tehuantepec, at the south of Mexico, may probably also have been submerged; thus isolating Guatemala and Yucatan, and leading to the specialization of some of the peculiar forms that now characterize those countries and Mexico.

#### EXPLANATIONS.

The species are numbered consecutively from first to last; the subspecies have added the letters a, b, c, etc., to the number of their respective species.

Species insufficiently described or doubtful for other reasons have their number followed by an interrogation point.

As far as possible with the present status of South American ichthyology the species of a genus have been grouped under their respective subgeneric names.

The families have been arranged, with slight modifications, after the system proposed by Cope and Gill. Those families and genera which have been reviewed by us have their genera and species arranged as in our Revisions. The genera and species of the other families have been arranged as in Günther's Catalogue of Fishes.

As in the A. O. U. Code and Check-list the name of each species and subspecies is followed by the name of the original describer inclosed in parentheses if it is not also the authority for the name adopted.

In selecting names we have tried to follow the canons of the A. O. U. Code implicitly in all cases but the following:

Canon XVII is to be modified to read: Between competitive, specific, or generic names published simultaneously in the same work preference is to be given to that which stands first in the book.

Canon XVIII is to be disregarded.

Canon XXV is made to read: A genus formed by the combination of two or more genera takes the name first given in a generic or subgeneric sense to either or any of its components.

After the name of the describer, is given the general habitat of the species. All the localities at which a species has been found have been compiled and on these notes the statement of the habitat of each species is based.

The habitat is followed in each case by a reference to some description of the species in question. If it is described in Dr. Günther's Cat-

atalogue of Fishes only the letter G. with the volume and page are given. Later works are referred to more in full. Unless the first description of species discovered since Dr. Günther's catalogue was published was insufficient or published in some obscure journal it is referred to. In those families which have lately been revised the revisions only are referred to.

The habitat is in each case followed by the synonyms of the species as determined by us or by the latest works of other authors.

## MARSIPOBRANCHII.

### HYPEROARTIA.

#### I. PETROMYZONTIDÆ.

##### 1. **EXOMEGAS** Gill.

1. **E. macrostomus** (Burmester). Buenos Ayres. G., VIII, 506.

##### 2. **CARAGOLA** Gray.

*Mordacia* Gray.

2. **C. mordax** (Richardson). Valparaiso. G., VIII, 507.

*C. lapicida* Gray; *Petromyzon anwandleri* aud *acutidens* Philippi.

##### 3. **GEOTRIA** Gray.

*Felasia* Gray.

3. **G. chilensis** (Gray). Chili. G., VIII, 509.

## PISCES.

### RAIÆ.\*

#### II. TORPEDINIDÆ.

##### 4. **NARCINE** Henle.

4. **N. brasiliensis** (Olfers). Atlantic coast of Tropical America, entering rivers. G., VIII, 453.

*Torpedo bancroftii* Griffith; *N. nigra* Dumeril; *Torpedo pictus* Gronow.

#### III. DASYBATIDÆ.

##### 5. **PARATRYGON** A. Duméril.

*Disceus* Garman.

5. **P. strongylopterus** (Schomburgk). British Guiana. G., VIII, 476.

\* The following species are recorded from the mouth of the La Plata: *Mustelus vulgaris* Müller and Henle: Günther; '80. *Raia platana* Günther; '80, a 11. *Raia microps* Günther; '80, a 12.

## 6, 7. POTAMOTRYGON Garman.

6. *P. brachyurus* Günther. La Plata. G., '80, 8.  
7. *P. hystrix* Müller & Henle. Roawa; Rio Plata; Apuré; Orinoco; Rio Branco. G., '80, 7.  
8. *P. d'orbignyi* Castlenau. Tocantins; Orinoco near Ciudad, Bolivar. G., VIII, 484.  
9. *P. reticulatus* Günther. La Plata; Surinam; Santarem. G., VIII, 482, as *T. hystrix*.  
10. *P. magdalense* Steind. Rio Magdalena. Steind., '78, 56.  
11. *P. motoro* Müller & Henle. Rio Cuyaba. G., VIII, 484.  
*Trygon garrapa* Schomburgk.  
12. *P. dumerilii* Castlenau. Araguay; Tocantins, Rio Crixas. G. VIII, 484.  
*T. mülleri* and *henlei* Castlenau.

## 8. ELLIPESURUS\* Schomburgk.

13. *E. spinicauda* Schomburgk. Rio Branco, near Fort Joaquim. G., VIII, 472.

## DIPNOI.

## IV. LEPIDOSIRENIDÆ.

## 9. LEPIDOSIREN Fitzinger.

*Amphibichthys* Hogg.

14. *L. paradoxa* F. Madeira near Barba; Amazon near Villa Nova. G., VIII, 322.  
*L. dissimilis* Castelnau.

## SYMBRANCHIA.

## V. SYMBRANCHIDÆ.

## 10. SYMBRANCHUS Bloch.

- Unibranchapertura* Lacépède; *Ophisternon* McClelland; *Tetrabanchus* Bleeker.  
15. *S. marmoratus* Bloch. Porto Alegre; Pernambuco; Amazons and northward. G., VIII.  
*S. immaculatus* Bloch; *S. transversalis* Bl. & Sohn.; *Unibranchapertura grisea* Lacép.; *Unibranchapertura lineata* Lacép.; *S. fuliginosus* Ranzani; *Muraena lumbricus* Gronow; *S. vittatus* Castelnau.

## NEMATOGNATHI.†

## VI. ASPREDINIDÆ.

## BUNOCEPHALINÆ.

## 11. BUNOCEPHALICHTHYS Bleeker.

16. *B. hypsiurus* (Kner). Rio Branco.

\**Ellipesurus* is retained only provisionally. "*Ellipesurus spinicauda* of Schomburgk is probably a mutilated specimen of one of the varieties" of *P. Dumerilii*. See Garman, '78.

†The species of this order are described in A Revision of the South American Nematognathi E. and E., 1890, and no other references will be given to descriptions.

12. **BUNOCEPHALUS** Kner.

*Aspredo* Swainson.

- 17. *B. scabriceps* Eigenm. & Eigenm. Jutahy.
- 18. *B. verrucosus* (Bloch). Amazon.
- 19. *B. gronovii* Bleeker. Mouth of Rio Negro, Guiana.
- 20. *B. bicolor* Steindachner. Solimoens and Marañon.
- 21. *B. melas* Cope. Marañon.
- 22. *B. kneri* Steind. Solimoens and Marañon.
- 23. *B. aleuropsis* Cope. Marañon.

13. **DYSICHTHYS** Cope.

- 24. *D. coracoides* Cope. Marañon (Nauta).

ASPREDININÆ.

14. **ASPREDO** Scopoli.

*Platystacus* Bloch. *Aspredo* Bleeker, not Swainson. *Cotylephorus* Swainson.

§ *Platystacus* Bloch.

- 25. *A. cotylephorus* Bloch. Surinam; Rio Para.  
*S. hexadactylus* Lacép.; *A. sex-cirrhis* C. & V.; *A. spectrum* Gronow.
- 26. *A. nematophorus* Bleeker. Surinam.

§ *Aspredo* Scopoli.

- 27. *A. aspredo* (Linnæus). Guiana; Rio Para; Lake Arary.  
*Plævis* Bloch; *A. batrachus* L.
- 28. *A. sicuephorus* Cuv. & Val. French Guiana.
- 29. *A. filamentosus* Cuv. & Val. Guianas.

§ *Asprednichthys* Bleeker.

- 30. *A. tibicen* (Temminck). Surinam; Brit. Guiana; Curuca, Rio Muria.

VII. **DIPLOMYSTIDÆ.**

15. **DIPLOMYSTES** Bleeker.

- 31. *D. papillosus* (Cuv. & Val.). Central Chili.  
*A. carcharias* Leybold; *A. villosus*, *squalus*, *micropterus*, *synodon* Philippi.

VIII. **SILURIDÆ.**

TACHISURINÆ.

16. **PARADIPLOMYSTES** Bleeker.

- 32. *P. coruscans* (Lichtenstein) habitat?

17. **GENIDENS** Castlenau.

- 33. *G. genidens* (Cuv. & Val.). La Plata; Aragnay.  
*G. curieri* Castlenau; *G. granulosus* Castlenau.

18. **TACHISURUS** Lacépède.

*Bagrus*, *Arius* Cuv. & Val.; *Sciades*, *Arioides* Müller & Troschel; *Cephalocassis*,  
*Guiratinga*, *Selenaspis*, *Hemiaris*, *Pseudarius* Bleeker; *Notarius* Gill.

34. **T. albicans** (Cuv. & Val.). Amazon. Enters rivers.  
*B. valenciennesi* Castlenau.
35. **T. herzbergii** (Bloch). Para. Enters rivers.  
*P. argenteus* Lacépède; *B. pemecus* Cuv. & Val.; *B. caelestinus* M. & T.; *H. hymenorhinus* Bleeker.
36. **T. upsilonophorus** (Eigenm. & Eigenm.). Rio Grande do Sul.
37. **T. barbatus** (Lacépède). Montevideo; Guahyba; Rio Grande do Sul; Rio Parahyba; Rio Doce; Araguay.  
*P. commersoni* Lac.; *B. barbatus* Quoy & Gaimard; *P. versicolor* Castlenau.
38. **T. grandoculis** (Steind.). Rio Doce.
39. **T. agassizii** Eigenm. & Eigenm. Rio Grande do Sul.
40. **T. spixii** (Agassiz). Para, Cayenne, Surinam. Enters rivers.  
*P. albidus* Spix; *A. arenatus* Cuv. & Val.; *A. laticeps* Günther.
41. **T. multiradiatus** Günther. Rio Bayano, Panama.

## CALLOPHYSINÆ.

19. **CALLOPHYSUS** Müller & Troschel.

*Pimelotropis* Gill; *Pseudocallophysus* Bleeker.

42. **C. macropterus** (Lichtenstein). Amazon; Solimões, Marañon, and northward.  
*P. ctenodus* Agassiz; *P. insignis* Schomb.; *P. lateralis* Gill.

## PIMELODINÆ.

20. **PIMELODINA** Steind.

43. **P. flavipinnis** Steind. Para.
44. **P. nasus** Eigenm. & Eigenm. Para.

21. **PINIRAMPUS** Bleeker.

45. **P. pinirampu** (Spix). Rio Tocantins to Venezuela.  
*P. typus* Bleeker; † *P. barbancho* Humboldt.

22. **LUCIOPIMELODUS** Eigenm. & Eigenm.

46. **L. pati** (Val.). Rio Plata; Rio Branco.
47. **L. platanus** (Günther). Rio Plata.

23. **PSEUDOPIMELODUS** Bleeker

*Zungaro* Bleeker.

§ *Lophosilurus* Steind.

48. **Ps. alexandri** Steind. Rio San Francisco.

§ *Batrachoglannis* Gill.

49. **Ps. parahybæ** Steind. Rio Parahyba to Rio Doce.

50. **Ps. raninus** (Cuv. & Val.). Rio Janeiro to Essequibo; Huallaga; Matto Grosso.

51. **Ps. pulcher** Boulenger. Eastern Ecuador.

§ *Pseudopimelodus* Bleeker.

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### 52. *Ps. zunigaro* (Humboldt). Rio Plata to Rio Magdalena.

*P. bufonius* Cuv. & Val.; *P. charus* Cuv. & Val.; *P. mangurus* Val.; *Z. humboldtii* Bleeker.

### 53. *Ps. acanthochira* Eigenm. & Eigenm. Amazon; Solimoens.

## 24. RHAMDIA Bleeker.

*Pteronotus* Swainson; *Pimelonotus* Gill; *Notoglanis* Günther.

### 54. ? *R. velifer* (Humboldt). Magdalena.

### 55. ? *R. argentinus* (Humboldt). Magdalena near Chilloa.

### 56. ? *R. laukidi* Bleeker. Guiana.

### 57. ? *R. grunniens* (Humboldt). Orinoco.

### 58. *R. breviceps* Kner. Marabitanos.

### 59. *R. schomburgkii* Bleeker. Brazil, Guiana.

### 60. *R. bathyurus* (Cope). Marañon.

### 61. *R. obesa* Eigenm. & Eigenm. Teffé.

### 62. *R. sebæ* (Cuv. & Val). Rio Janeiro to Rio Magdalena; Amazon; Solimoens.

*P. steglichii* M. & T.; *P. musculus* M. & T.; *P. holomelas* Günther; *P. mülleri* Günther.

### 63. *R. sebæ kneri* (Steind.). Amazon, Solimoens, and northward.

### 64. *R. foia* (M. & T). Takutu, Guiana.

### 65. *R. humilis* (Günther). Marañon; Venezuela.

### 66. *R. cinerascens* (Günther). Guayaquil; Esmeraldas.

### 67. *R. pentlandi* (Cuv. & Val.). Titicaca; Monterico; Tulumayo; Rio de Huambo.

### 68. *R. quelen* (Quoy & Gaimard). La Plata to Amazon.

*Pimelodus sellonis* Müller & Troschel; ? *Pimelodus bahianus* Castelnau; *Silurus sapipoca* Natterer; *Pimelodus wuchereri* Günther; *Pimelodus queleni cuprea* Steind.; *Pimelodus cuyabæ* Steindachner.

### 69. *R. multiradiatus* (Kner). Amazon; Solimoens; Madeira; Esequibo.

*Pimelodus arekaima* Schomburgk, description, not plate.

### 70. *R. sapo* (Val.). Rio Plata; southern Brazil.

### 71. *R. hilarii* (Cuv. & Val.). Rio San Francisco to La Plata.

### 72. *R. wagneri* (Günther). East and west slopes of Panama and Central America.

*Pimelodus cinerascens* Kner & Steind. (not Günther); *Rhamdia bransfordii* Gill.

### 73. *R. longicauda* Boulenger. Canelos.

### 74. *R. dorsalis* Gill. Marañon.

### 75. *R. poeyi* Eigenm. & Eigenm. Goyaz.

### 76. *R. tenella* Eigenm. & Eigenm. Cudajas.

## 25. RHAMDELLA Eigenm. & Eigenm.

### 77. *R. microcephala* (Reinhardt). Rio das Velhas.

### 78. *R. notata* (Schomburgk). Rio Branco.

### 79. *R. eriarcha* Eigenm. & Eigenm. Rio Grande do Sul.

### 80. *R. exsudans* (Jenyns). Rio Janeiro.

### 81. *R. jenynsii* (Günther). Rio Janeiro; Maldonado.

*Pimelodus gracilis* Jenyns (not Val.).

### 82. *R. minuta* Lütken. Macacos; Rio das Velhas; Rio de Janeiro.

26. **HEPTAPTERUS** Bleeker.

83. *H. mustelinus* (Val.). Rio Grande do Sul; Rio Plata.

27. **ACENTRONICHTHYS** Eigenm. & Eigenm.

84. *A. leptos* Eigenm. & Eigenm. Sao Mateos.

85. *A. surinamensis* (Bleeker). Surinam.

86. *A. collettii* (Steind.). Rio Plata.

28. **NANNOGLANIS** Boulenger.

87. *N. fasciatus* Boulenger. Ecuador.

29. **PIMELODELLA** Eigenm. & Eigenm.

88. *P. cristatus* (Müller & Troschel). Rivers north of Cape San Roque.

*Pimelodus insignis* Schomburgk, description, not plate; *Pimelodus agassizii* Steindachner; *Pimelodus ophthalmicus* Cope.

89. *P. wesseli* (Steind.). Rio Puty to Essequibo; Amazon.

90. *P. gracilis* (Valenciennes). La Plata to Orinoco.

91. *P. pectinifer* Eigenm. & Eigenm. Rio Parahyba.

92. *P. modestus* (Günther). Western Ecuador; eastern Panama.

93. *P. elongatus* (Günther). Western Ecuador.

94. *P. lateristriga* (Müller & Troschel). North of Rio Parahyba.

95. *P. harttii* (Steind.). Rio Parahyba.

96. *P. buckleyi* (Boulenger). Rio Parahyba; Amazon; Marañon.

97. *P. vittata* (Kröyer). Atlantic slopes of Minas Geraes and Bahia.

98. *P. chagresi* (Steind.). Rio Chagres.

99. *P. brasiliensis* (Steind.) Rio Parahyba.

30. **PIMELODUS** Lacépède.

*Pseudariodes* Bleeker; *Pseudorhamdia* Bleeker.

100. *P. cyanostigma* (Cope). Pebas, Ecuador.

101. *P. quadrimaculatus* (Bloch). ? America.

102. *P. eques* Müller & Troschel. Amazon, Solimoes, and northward.

103. *P. ornatus* Kner. Amazon, Solimoes, and northward.

*Silurus megacephalus* Natterer.

104. *P. albicans* (Cuv. & Val.). Rio Plata.

*Arius albidus* Val.; *Arius moroti* Val.

105. *P. pictus* Steind. Marañon.

106. *P. clarias* (Bloch). Rio Plata to Rio Magdalena.

*Pimelodus maculatus* Lacépède; *Pimelodus rigidus* Spix; *Pimelodus blockii* Cuv. & Val.; *Pimelodus arekaima* Schomburgk (plate, not description); *Mystus ascia* Gronow; *Pimelodus macronema* Bleeker; *Pseudariodes albicans* Lütken; ? *Pseudariodes pantherinus* Lütken; *Pseudorhamdia piscatrix* Cope; *Piramutana macrospila* Günther.

107. *P. grosskopffii* Steind. Rio Magdalena and tributaries.

108. *P. labrosus* Kröyer. La Plata.

109. *P. valenciennis* Kröyer. Rio Plata.

110. *P. westermanni* Reinhardt. Rio das Velhas.



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111. *P. altipinnis* Steind. Amazon; Demarara.  
112. *P. fur* Reinhardt. Amazon; Rio Negro; Rio San Francisco.  
*Pimelodus microstomus* Steind.

31. Nov.?

113. *Pirinampus agassizii* Steind. Amazon; Marañon.

32. CONORHYNCHOS Bleeker.

§ *Conorhynchos*.

114. *C. conirostris* (Cuv. & Val.). Rio San Francisco.

§ *Nov. ?*

115. *C. glaber* Steind. Porto Seguro.

33. BAGROPSIS Lütken.

116. *B. reinhardti* Lütken. Rio das Velhas.

34. PIRAMUTANA Bleeker.

117. *P. piramuta* (Kner). Amazon; Solimoens; Rio Negro; Rio Madeira.

35. PLATYNEMATICHTHYS Bleeker.

118. *P. punctulatus* (Kner). Amazon, Solimoens, and tributaries.  
*Bagrus nigripunctatus* Kner.

119. *P. araguayensis* (Castelnau). Araguay.

36. PHRACTOCEPHALUS Agassiz.

120. *P. hemiliopterus* (Bloch & Schneider). Amazon, Solimoens, Marañon, their tributaries, and northward.  
*Phractocephalus bicolor* Agassiz.

37. SCIADES Müller & Troschel.

*Leiarius* § *Sciadeichthys* Bleeker.

§ *Sciades* M. & T.

121. *S. pictus* M. & T. Amazon and tributaries.

§ *Sciadeoides* Eigenm. & Eigenm.

122. *S. marmoratus* Gill. Marañon.

38. NEMUROGLANIS Eigenm. & Eigenm.

123. *N. lanceolatus* Eigenm. & Eigenm. Jutahy.

39. BRACHYPLATYSTOMA Bleeker.

*Piratinga* Bleeker; *Malacobagrus* Bleeker.

124. *B. filamentosus* (Lichtenstein). Brazil.

125. *B. vaillanti* Cuv. & Val. Eastern slopes of South America north of Rio Parahyba.

*P. affine* (Cuv. & Val.); *P. mucosa* Vaillant; *P. verrucosum* Boulenger.

126. *B. reticulatum* (Kner). Rio Tocantins; Amazon and tributaries; Rio Madeira.  
127. *B. rousseauxii* (Castlenau). Amazon.  
*B. goliath* Heckel.

40. **DUOPALATINUS** Eigenm. & Eigenm.

128. *D. emarginatus* (Cuv. & Val.). Rio San Francisco.

41. Nov.?

129. *Platystoma lütkeni* Steind. Amazon.

42. **STEINDACHNERIA** Eigenm. & Eigenm.

130. *St. amblyura* Eigenm. & Eigenm. Rio Jequitinhonha.  
131. *St. doceana* Eigenm. & Eigenm. Rio Doce.  
132. *St. parahybæ* Steind. Rio Parahyba.

43. **HEMISORUBIM** Bleeker.

133. *H. platyrhynchus* (Cuv. & Val.). Orinoco; Amazons; Paranahyba.

44. **PSEUDOPLATYSTOMA** Bleeker.

*Hemiplatystoma* Bleeker.

134. *Ps. fasciatum* (Linnaeus). Amazons and northward.  
! *Pl. truncatum* Agassiz; *Pl. punctifer* Castlenau.  
134a. *Ps. f. nigricans* Eigenm. & Eigenm. Xingu.  
134b. *Ps. f. brevifile* Eigenm. & Eigenm. Goyaz.  
134c. *Ps. f. intermedium* Eigenm. & Eigenm. Obidos; Rio Puty.  
134d. *Ps. f. reticulatum* Eigenm. & Eigenm. Rio Negro.  
135. *Ps. tigrinum* (Cuv. & Val.). Amazons; Guiana.  
136. *Ps. coruscans* (Agassiz). Rio San Francisco; La Plata.  
*Sorubim caparary* Spix; *Platystoma pardalis* Val.; *Platystoma punctatum* Cuv. & Val.; *Platystoma orbignianum* Val.; *Platystoma forschhammeri* Reinhardt.

45. **SORUBIM** Spix.

*Platystoma* Agassiz.

137. *S. lima* (Bloch & Schneider). Rio Plata; Amazons and tributaries; Orinoco; Magdalena.  
*Sorubim infraocularis* Spix; *Platystoma luceri* Weyenbergh.

46. **SORUBIMICHTHYS** Bleeker.

138. *S. planiceps* (Agassiz). Amazons; Orinoco.  
*Sorubim pirauaca* Spix; *Platystoma artedii* Günther; *Sorubimichthys ortonii* Gill.  
139. *S. spatula* (Agassiz). ! Amazon.  
*Sorubim jandia* Spix.  
140. *S. gigas* (Günther). Huallaga.

47. **PLATYSTOMATICHTHYS** Bleeker.

141. *P. sturio* (Kner). Amazon and tributaries.

DORADINÆ.

48. **PHYSOPYXIS** Cope.

142. *P. lyra* Cope. Ambyiacu.

49. **DORAS** Lacépède.

*Centrochir* Agassiz; *Lithodoras*, *Pterodoras*, *Platydoras*, *Acanthodoras*, *Astrodoras* & *Amblydoras* Bleeker; *Zathorax* & *Agamyxis* Cope.

§ *Lithodoras* Bleeker.

143. *D. dorsalis* Cuv. & Val. Para; Rio Negro; Cayenne.  
*Doras papilionatus* Filippi; *Doras lithogaster* Heckel.

§ *Doras* Lacépède.

144. *D. uranoscopus* Eigenm. & Eigenm. Lake Hyanuary.

145. *D. maculatus* Val. Rio Plata; Amazon; Demarara.  
? *Doras granulatus* Val.; *Doras murica* Natterer.

146. *D. longipinis* Steind. Rio Magdalena.  
? *Doras crocodili* Humboldt.

147. *D. albomaculatus* Peters. Calabozo.

148. *D. helicophilus* Günther. Surinam.

149. *D. dentatus* Kner. Surinam.

150. *D. costatus* (Linnæus). Rio San Francisco; Amazon; Solimoens; Guiana region.

151. *D. armatulus* Cuv. & Val. Upper courses of Brazilian rivers; Venezuela.

152. *D. hancockii* Cuv. & Val. Cupai.

153. *D. brachiatus* Cope. Marañon.

§ *Acanthodoras* Bleeker.

154. *D. calderonensis* Vaillant. Lago Alexo; Calderon.  
*Doras depressus* Steind.

155. *D. cataphractus* (Linnæus). Central Brazil; Guiana.  
*Cataphractus americanus* Bloch & Schneider; *Doras blochii* Cuv. & Val.; ? *Doras brunnescens* Schomburgk; *Doras polygramma* and *polygramma* Heckel; *Callichthys asper* Gronow.

156. *D. spinosissimus* Eigenm. & Eigenm. Coary.

157. *D. marmoratus* Reinhardt. Rio San Francisco

§ *Amblydoras* Bleeker.

158. *D. affinis* Kner. Rio Branco; Rio Guapore.  
*Doras truncatus* Bleeker.

159. *D. weddellii* Castlenau. Amazons.  
*Doras grypus* Cope.

§ *Centrochir* Agassiz.

160. *D. crocodili* Humboldt. Rio Magdalena.

§ *Agamyxis* Cope.

161. *D. castaneo-ventris* Schomburgk. Passawiri.

162. *D. pectinifrons* Cope. Pebas, Ecuador,

§ *Astrodoras* Bleeker.

163. *D. asterifrons* Heckel. Amazon, Solimoens, and tributaries.  
164. *D. heckelii* Kner. Solimoens.  
165. *D. monitor* Cope. Amazon.  
166. *D. nauticus* Cope. Marañon.

50. *OXYDORAS* Kner.

*Pseudodoras* and *Rhinodoras* Bleeker.

§ *Oxydoras* Kner.

167. *O. niger* (Val.). Amazonas and northward; Rio San Francisco.  
*Doras humboldti* Agassiz; *Corydoras edentatus* Spix; *Rhinodoras prionomus* Cope;  
*Rhinodoras teffeanus* Steind.  
168. *O. kneri* Bleeker. Cujaba.

§ *Rhinodoras* Bleeker.

169. *O. d'orbigny* Kröyer. La Plata.  
170. *O. amazonum* (Steind.). Teffe.

51. *HEMIDORAS* Bleeker.§ *Hemidoras* Bleeker.

171. *H. nattereri* (Steind.). Solimoens.  
172. *H. brevis* (Kner). Barra do Rio Negro; Calderon.  
173. *H. fimbriatus* (Kner). Rio Guapore.  
174. *H. punctatus* (Kner). Rio Guapore.  
175. *H. lipophthalmus* (Kner). Rio Negro; Rio Capin.  
176. *H. accipenserinus* (Günther). Xeberos.  
177. *H. stenopeltis* (Kner). Amazon; Solimoens.  
178. *H. stüblii* (Steind.). Huallaga.  
179. *H. morei* (Steind.). Rio Negro.  
180. *H. humeralis* (Kner). Rio Negro.  
181. *H. carinatus* (Linnæus). Calderon; Surinam; Cayenne; Essequibo.  
*Doras oxyrhynchus* Val.

§ *Hassar* Eigenm. & Eigenm.

182. *H. orestes* (Steind.). Xingu; Jutahy.  
183. *H. affinis* (Steind.). Rio Puty.

## AUCHENIPTERINÆ.

52. *ASTEROPHYSUS* Kner.

184. *A. batrachus* Kner. Marabitanos.

53. *TRACHELYOPTERICHTHYS* Bleeker.

185. *T. tæniatus* Kner. Solimoens and tributaries.

54. *TRACHELYOPTERUS* Cuv. & Val.

186. *T. coriaceus* Cuv. & Val. Amazon; Cayenne.  
186a. *T. c. maculosus* Eigenm. & Eigenm. Porto do Moz.

55. **WERTHEIMERIA** Steind.

187. *W. maculata* Steind. Jequitinhonha.

56. **CENTROMOCHLUS** Kner.

- 187½. *Arius oncina* Schomburgk. Rio Padauri.  
 188. *C. heckelii* (Filippi). Amazonas and tributaries.  
*Centromochlus megalops* Kuer.  
 189. *C. steindachneri* Gill. Maraflon.  
 190. *C. intermedius* Steind. Amazon; Solimoes and tributaries.  
 191. *C. perugiae* Steind. Canelos.  
 192. *C. aulopygius* Kuer. Rio Guapore; Cudajas; Essequibo.

56½. **GLANIDIUM** Lütken.

193. *G. albescens* Lütken. Coast streams from Rio Janeiro to the Amazon.

57. **TRACHYCORYSTES** Bleeker.

194. *T. glaber* (Steind.). Demarara.  
 195. *T. isacanthus* (Cope). Maraflon.  
 196. *T. insignis* (Steind.). Magdalena.  
 197. *T. obscurus* (Günther). Essequibo.  
 198. *T. magdalenæ* (Steind.). Magdalena.  
 199. *T. trachycorystes* (Cuv. & Val.). ?  
*Trachycorystes typus* Bleeker.  
 200. *T. ceratophysus* (Kner). Guapore; Rio Negro and Branco.  
 201. *T. porosus* Eigenm. & Eigenm. Brazil.  
 202. *T. striatulus* Steind. Mouths of rivers draining eastern Minas Geraes; Para.  
 203. *T. brevibarbus* (Cope). Maraflon.  
 204. *T. galeatus* (Linnaeus). Rio das Velhas to the Orinoco.  
*Auchenipterus maculosus, immaculatus* and *punctatus* Cuv. & Val. *Auchenipterus lacustris* Lütken.  
 205. *T. robustus* Günther. Demarara.  
 206. *T. analis* Eigenm. & Eigenm. ? Arary.

58. **AUCHENIPTERICHTHYS** Bleeker.

207. *A. thoracatus* (Kner). Solimoes and tributaries.  
 208. *A. longimanus* (Günther). Southern tributaries of the Amazon.

59. **PSEUDAUCHENIPTERUS** Bleeker.\*

209. *Ps. jequitinhonhae* (Steind.). Jequitinhonha.  
 210. *Ps. flavescens* Eigenm. & Eigenm. Rio San Francisco.  
 211. *Ps. affinis* (Steind.). Para; mouths of streams draining eastern Minas Geraes.  
 212. *Ps. nodosus* Bloch. Bahia; Para; Guiana.  
*A. furcatus* Cuv. & Val.

60. **EPAPTERUS** Cope.

213. *E. dispilurus* Cope. Hyavary; Maraflon.  
*Euanemus longipinnis* Steind.

\* Gill, Proceeding National Museum, Vol. XIII, p. 353; E. & E., p. 285.

61. **AUCHENIPTERUS** Cuv. & Val.*Euanemus* M. & T.

214. *A. nuchalis* (Spix). Amazonas; Surinam.  
*A. dentatus* Cuv. & Val.; *E. colymbetes* M. & T.  
215. *A. fordicei* Eigenm. & Eigenm. Coary.  
216. *A. brachyurus* (Cope). Peru.

62. **TETTRANEMATICTHYS** Bleeker.

217. *T. quadrifilis* (Kner). Rio Guapore.

## AGENEIOSINÆ.

63. **AGENEIOSUS** Lacépède.

*Ceratorhynchus* Agassiz; *Hypothalmus* Schomburgk; *Pseudagenciosus* and *Dawalla* Bleeker; *Ageniosus* Günther.

218. *A. inermis* (Linnaeus). Surinam.

§ *Agenciosus* Lacépède.

219. *A. brevis* Steind. Solimoens; Coary.  
220. *A. atronasus* Eigenm. & Eigenm. † Brazil.  
221. *A. valenciennesi* Bleeker. La Plata to Rio Puty.  
222. *A. armatus* Lacépède. Surinam.  
223. *A. ucayalensis* Castelnau. Para; Ucayale.  
224. *A. caucanus* Steind. Cauca.  
225. *A. dentatus* Kner. Amazon; Solimoens; to Guiana and Rio Magdalena.  
*Agenciosus pardalis* Lütken.  
226. *A. porphyreus* Cope. Surinam.  
227. *A. dawalla* (Schomburgk). Amazon; Guiana.  
• *Agenciosus inermis* Cuv. & Val., not of Bloch; *Agenciosus sebæ* Günther.

§ *Pseudagenciosus* Bleeker.

228. *A. brevifilis* Cuv. & Val. Amazons; Guiana; Upper Paraguay.  
229. *A. axillaris* Günther. Surinam.

IX. **HYPOPHTHALMIDÆ.**64. **HELOGENES** Günther.

230. *H. marmoratus* Günther. Essequibo.

65. **HYPOPHTHALMUS** Spix.

*Notophthalmus* Hyrtl; *Pseudohypophthalmus* Bleeker.

231. *H. edentatus* Spix. Amazons and tributaries, and northward.  
*Hypophthalmus marginatus*, *H. longifilis*, and *H. spixii* Cuv. & Val. *Hypophthalmus edentulus* Castelnau; *Hypophthalmus fimbriatus* Kner; *Hypophthalmus perporosus* Cope.

## X. PYGIDIDÆ.

## CETOPSINÆ.

## 66. CETOPSIS Agassiz.

§ *Hemicetopsis* Bleeker.

232. *C. candiru* (Spix). Rio Cupai to Rio Huallaga.

233. *C. plumbeus* Steind. Canelos.

§ *Cetopsis* Agassiz.

234. *C. cœcutiens* (Lichtenstein). Amazon from Gurupa to Rio Cupai.

§ *Pseudocetopsis* Bleeker.

235. *C. gobioides* Kner. Irisanga.

§ *Subgen. nov. ?*

236. *C. occidentalis* Steind. Guayaquil.

237. *C. ventralis* Gill. Marañon.

## PYGIDIINÆ.

## 67. NEMATOGENYS Girard.

238. *N. inermis* (Guichenot). Fresh waters of Central Chili.

*N. nigricans* and *pallidus* Philippi.

## 68. PARIOLIUS Cope.

239. *P. armillatus* Cope. Ambyiacu.

## 69. PYGIDIUM Meyen.

240. ? *P. fuscum* Meyen. Peru.

241. ? *P. palleanum* (Philippi). Chili.

242. ? *P. marmoratum* (Philippi). Chili.

243. ? *P. tenue* (Weyenbergh). Sierra de Cordoba near Cruz-de-ojo.

244. ? *P. corduvense* (Weyenbergh). Rio Primero.

245. ? *P. tigrinum* (Philippi). Chili.

246. *P. macræi* (Girard). Uspullata.

247. *P. maculatum* (Cuv. & Val.). Western slopes of Central Chili.

248. *P. areolatum* (Cuv. & Val.). Western slopes of Central Chili.

249. *P. rivulatum* (Cuv. & Val.). Titicaca; Ucayale and tributaries.

*T. inca, gracilis, barbatula* Cuv. & Val.; *T. pentlandi, pictus* Castelnau.

250. *P. poeyanum* (Cope). Western slopes of southern Peru.

251. *P. brasiliense* (Reinhardt). Rio Janeiro to Rio San Francisco.

252. *P. tænia* (Kner). Western slopes of Peruvian Andes.

253. *P. laticeps* (Kner). Western slopes of the Peruvian Andes.

254. *P. oroyæ* Eigenm. & Eigenm. Oroya River.

255. *P. punctatissimum* (Castelnau). Araguay.

256. *P. kneri* (Steind.). Eastern slopes of Ecuador; Cumbaca.

257. *P. dispar* (Tschudi.). Eastern and western slopes of Peruvian Andes.

258. *P. d. punctulatum* (Cuv. & Val.). Western slopes of Peruvian Andes.

259. *P. nigromaculatum* (Boulenger). Colombia.  
260. *P. pardus* (Cope). Jequetepoque; Callao Bay.  
261. *P. immaculatum* Eigenm. & Eigenm. Juiz de Fora; Sao Matheos; Goyaz.  
262. *P. taczanowskii* (Steind.). Rio de Huambo; Rio de Tortora.  
263. *P. nigricans* (Cuv. & Val.). Santa Catherina.  
264. *P. amazonicum* (Steind.). Cudajas.

70. **EREMOPHILUS** Humboldt.

*Thricomycterus* Humb.; *Trachypoma* Giebel.

265. *E. mutisii* Humboldt. Rio Magdalena.  
*E. marmoratum* Giebel.

71. **TRIDENS** Eigenm. & Eigenm.

266. *T. melanops* Eigenm. & Eigenm. Iça.  
267. *T. brevis* Eigenm. & Eigenm. Tabatinga.

STEGOPHILINÆ.

72. **PSEUDOSTEGOPHILUS** Eigenm. & Eigenm.

268. *P. nemurus* (Günther). Marañon.

73. **STEGOPHILUS** Reinhardt.

269. *S. maculatus* Steind. La Plata.  
270. *S. punctatus* Boulenger. Canelos.  
271. *S. intermedius* Eigenm. & Eigenm. Goyaz.  
272. *S. macrops* Steind. L. Manacapuru.  
273. *S. insidiosus* Reinhardt. Rio das Velhas.  
274. *S. reinhardti* Steind. Solimoes and tributaries.

74. **VANDELLIA** Cuv. & Val.

275. *V. cirrhosa* Cuv. & Val. Hyavary.  
276. *V. plazai* Castelnau. Lake Hyannary; Calderon; Ucayale.

75. **PAREIODON** Kner.

*Centrophorus* Kner; *Astemomycterus* Guichenot.

277. *P. microps* Kner. Amazons; Aruguay; Ambyiacu.  
278. *T. pusillus* Castelnau.

76. **MIUROGLANIS** Eigenm. & Eigenm.

279. *M. platycephalus* Eigenm. & Eigenm. Jutahy.

XI. ARGHIDÆ.

77. **ARGES** Cuv. & Val.

*Brontes* Cuv. & Val.

280. *A. sabalo* Cuv. & Val. Peruvian Andes and Cordilleras.  
281. *A. prenadilla* Cuv. & Val. Peruvian Andes.  
*A. brachycephalus* Günther.



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282. *A. longifilis* Steind. Rio Huambo.  
283. *A. peruanus* Steind. Peruvian Andes.  
283½. *A. whympersi* Boulenger.\*  
284. *A. taczanowskii* Boulenger.\*

78. **CYCLOPIUM** Swainson.

*Stygogenes* Günther.

285. *C. cyclopyum* (Humboldt). Andes of Ecuador.  
*C. humboldti* Swainson; *St. humboldti* Günther.  
286. *C. güntheri* Boulenger. Colombia.

79. **ASTROBLEPUS** Humboldt.

287. *A. grixalvii* Humboldt. Rio Magdalena system.

XII. **LORICARIIDÆ.**

LORICARIINÆ.

80. **FARLOWELLA** Eigenm. & Eigenm.

*Acestra* Kner. Preoccupied in Hem.

288. *F. gladiola* (Günther). Rio Cupai.  
289. *F. carinata* Garman. Amazon; Solimoens.  
290. *F. kneri* (Steind.). Ucayale and Pastaza Rivers.  
291. *F. oxyrhynchus* (Kner). Rio Mamore.  
292. *F. amazona* (Günther). Santarem.  
293. *F. acus* (Kner). Caracas.  
? *L. scolapacina* Filippi.

81. **HEMIODONTICHTHYS** Bleeker.

294. *H. acipenserinus* (Kner). Solimoens; Marañon and tributaries.

82. **LORICARIA** Linnæus.

*Hemiloricaria*; *Oxyloricaria* Bleeker.

295. ? *L. platyura* M. & T. Rupununi.  
296. ? *L. caracasensis* (Bleeker). Caracas.  
297. ? *L. bransfordi* Gill. Panama.  
298. ? *L. cadeæ* Hensel. Rio Cadea.

§ *Hemiodon* Kner.

299. *L. depressa* (Kner). Rio Negro.  
300. *L. panamensis* Eigenm. & Eigenm. Panama.

§ *Sturisoma* Swainson.

301. *L. rostrata* Spix. Cujaba; Solimoens; Marañon; Calabozo; Panama.  
*L. acuta* Cuv. & Val., plate; *L. barbata* Kner.

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\* The two species, 283½ and 284, have been described by Mr. Boulenger in an article received since the transmission of this catalogue for publication. (See Proc. Zool. Soc. London, 1890, pp. 450, 451.)

§ *Rineloricaria* Bleeker.

302. *L. brevirostris* Eigenm. & Eigenm. Ica.  
303. *L. lima* Kner. Rio Parahyba to Para; Atlantic and Pacific slopes of Panama.  
*L. strigilata* Hensel.  
304. *L. magdalenæ* Steind. Magdalena.  
305. *L. filamentosa* Steind. Canelos, Magdalena.  
306. *L. brunnea* Hancock. Demarara.

§ *Pseudohemiodon* Bleeker.

307. *L. platycephala* (Kner). Rio Cujaba.

§ *Parahemiodon* Bleeker.

308. *L. uracantha* Kner & Steind. Eastern and western slopes of Panama.  
309. *L. stübelii* Steind. Amazons; Rio Preto; Rio Puty.  
310. *L. spixii* Steind. Southeastern Brazil.  
311. *L. typus* (Bleeker). Surinam.  
*L. hemiodon* Günther.  
312. *L. phoxocephala* Eigenm. & Eigenm. Coary.  
313. *L. anus* Valenciennes. La Plata; Rio Grande do Sul.

§ *Loricariichthys* Bleeker.

314. *L. acuta* Cuv. & Val. Amazons.  
? *L. castanea* Castelnau; *L. maculata* Günther.  
315. *L. maculata* Bloch. Rio Guapore; Calderon; Surinam.  
316. *L. konopickyi* Steind. Amazon; Calderon.  
*L. valenciennesi* Vaillant.  
317. *L. lanceolata* Günther. Xeberos; Canelos.  
318. *L. teffeana* Steind. Solimoens.

§ *Pseudoloricaria* Bleeker.

319. *L. læviuscula* Cuv. & Val. Amazon; Solimoens and tributaries.

§ *Loricaria* Linnæus.

320. *L. variegata* Steind. Mamoni River.  
321. *L. macrodon* Kner. Cujaba.  
322. *L. nudiventris* Cuv. & Val. Rio San Francisco.  
*L. dura* L.; *L. cirrhosa* Bl. & Sch.; *L. setifera*; *L. carinata* Castelnau; *P. flagellaris* Gronow.  
323. *L. cataphracta* Linnæus. Rio Preto; Amazons; Guiana.  
324. *L. lata* Eigenm. & Eigenm. Goyaz.  
325. *L. macromystax* Günther. Marañon.  
326. *L. vetula* Valenciennes. Buenos Ayres.  
327. *L. lamina* Günther. Xeberos.  
328. *L. platystoma* Günther. Surinam.

83. **HARTTIA** Steind.

329. **H. loricariformis** Steind. Southeastern Brazil.

84. **OXYROPSIS** Eigenm. & Eigenm.

330. **O. wrightii** Eigenm. & Eigenm. Lake Hyanyary.

HYPOPTOMINÆ.

85. **HYPOPTOPOMA** Günther.

331. **H. thoracatum** Günther. Solimoens, Marañon, and northward.  
*H. bilobatum* Cope; *Otocinclus joberti* Vaillant.

332. **H. gulare** Cope. Marañon.

333. **H. carinatum** Steind. Solimoens near Peruvian Amazon.

86. **HISONOTUS** Eigenm. & Eigenm.

334. **H. notatus** Eigenm. & Eigenm. Santa Cruz; Juiz de Fora.

87. **PAROTOCINCLUS** Eigenm. & Eigenm.

335. **P. maculicauda** (Steind.). Santa Cruz.

88. **OTOCINCLUS** Cope.

336. **O. affinis** Steind. Santa Cruz near Rio de Janeiro.

337. **O. vestitus** Cope. Ambyacu.

PLECOSTOMINÆ.

88½. **MICROLEPIDGASTER** Eigenm. & Eigenm.

338. **M. perforatus** Eigenm. & Eigenm.

89. **NEOPLECOSTOMUS** Eigenm. & Eigenm.

339. **N. granosus** (Cuv. & Val.). Cayenne.

340. **N. microps** (Steind.). Rio Janeiro; Rio Parahyba; Goyaz.

90. **PLECOSTOMUS** Gronow.

*Hypostomus* Lacépède.

341. **P. emarginatus** Cuv. & Val. Amazons and tributaries; Guianas; Magdalena.  
*H. horridus* Kner; *H. squalinum* Schomb.; *P. scapularius* Cope; *P. tenuicauda* Steind.

342. **P. spinosissimus** Steind. Rivers near Guayaquil.

344. **P. commersonii** (Val.). Southeastern Brazil; Rio Plata and tributaries.  
*H. punctatus* Cuv. & Val.; *H. subcarinatus* Castelnau; *Pl. spiniger* Hensel.

- 344a. **P. commersonii scabriceps** Eigenm. & Eigenm. Sao Matheos.

- 344b. **P. commersonii affinis** Steind. Southeastern Brazil.

345. **P. limosus** Eigenm. & Eigenm. Rio Grande do Sul.

346. **P. carinatus** Steind. Amazons.

347. **P. plecostomus** (Linnaeus). Rio Pnty; Amazons and northward.  
*H. guacari* Lacépède; *L. flava* Shaw; *H. veres* Cuv. & Val.; *Pl. bicirrhosus* Gronow; *Pl. brasiliensis* Bl.

348. *P. vaillanti* Steind. East central Brazil.  
349. *P. villarsi* Lütken. Caracas.  
350. *P. virescens* Cope. Marañon.  
351. *P. biserialatus* Cope. Amazon.  
352. *P. seminudus* Eigenm. & Eigenm. † Brazil.  
353. *P. annæ* Steind. Para.  
354. *P. pentherinus* (Kner). Rio Guaporé.  
355. *P. cordovæ* Günther. Cordova.  
356. *P. lima* Reinhardt. Rio San Francisco; Rio Grande do Sul.  
357. *P. macrops* Eigenm. & Eigenm. Rio das Velhas.  
358. *P. francisci* Lütken. Rio San Francisco; Rio das Velhas.  
359. *P. alatus* (Castelnau). Araguay; Rio das Velhas.  
360. *P. auroguttatus* (Kner). Coast streams of southeastern Brazil.  
361. *P. lütkeni* Steind. Southeastern Brazil.  
362. *P. vermicularis* Eigenm. & Eigenm. Eastern Brazil.  
363. *P. brevicauda* Günther. Bahia.  
364. *P. robinii* Cuv. & Val. La Plata to Trinidad.  
*P. næ* Steind.  
365. *P. wuchereri* Günther. Bahia to Rio Mucuri.  
366. *P. johnii* Steind. Rio Preto; Rio Puty.

### 91. RHINELEPIS Spix.

367. *R. parahybæ* Steind. Rio Parahyba.  
368. *R. agassizii* Steind. Mauacapuru; Rio Huallaga.  
369. *R. aspera* Spix. Rio San Francisco; † Parana; † Guiana.  
*R. strigosa* Cuv. & Val.

### 92. HEMIANCISTRUS Bleeker.

*Pseudacanthicus* Bleeker; *Charostomus* Günther.

370. *H. serratus* (Cuv. & Val.). Surinam.  
371. *H. histrix* (Cuv. & Val.). Brazil.  
372. *H. spinosus* (Castelnau). Amazon; † Porto Alegre.  
373. *H. medians* (Kner). Surinam.  
374. *H. pictus* (Kner). Barra do Rio Negro.  
375. *H. brachyurus* (Kner). Barra do Rio Negro.  
376. *H. itacua* (Valenciennes). La Plata.  
377. *H. scaphirhynchus* (Kner). Solimoens.  
378. *H. fordii* Günther. Surinam.  
379. *H. heteracanthus* (Günther). Marañon.  
380. *H. aspidolepis* (Günther). Veragua.  
381. *H. mystacinus* (Kner). Caracas.  
382. *H. oligospilus* (Günther). River Capin.  
383. *H. megacephalus* (Günther). Surinam.  
384. *H. guacharote* (Cuv. & Val.). Porto Rico, Trinidad.  
385. *H. trinitatis* (Günther). Trinidad.  
386. *H. vittatus* (Steind.). Amazon.

93. **PARANCISTRUS** Bleeker.

387. *P. punctatissimus* Steind. Araguay; Amazon.  
*H. niveatus* Castelnau.  
 388. *P. aurantiacus* (Castelnau). Ucayale.  
 389. *P. nigricans* (Castelnau). Amazon.

94. **COCHLIODON** Heckel.

390. *C. cochliodon* Kner. Rio Cujaba.  
*C. hypostomus* Heckel; *L. melanoptera* Natterer.

95. **PANAQUE** Eigenm. & Eigenm.

391. *P. nigrolineatus* (Peters). Orinoco; Goyaz.  
 392. *P. cochliodon* (Steind.). Cauca.  
 393. *P. dentex* (Günther). Xeberos.

96. **PTERYGOPLICHTHYS** Gill.

*Liposarcus* Günther.

394. *Pt. undecimalis* (Steind.). Magdalena; Cauca.  
 395. *Pt. etentaculatum* (Spix). Rio San Francisco.  
*H. duodecimalis* Cuv. & Val.; *H. brevitentaculatus* Ranzani; *A. longimanus* Kner.  
 396. *Pt. gibbiceps* (Kner). Amazon; Solimoens.  
 397. *Pt. punctatus* (Natterer). S. Vicente; Solimoens.  
 398. *Pt. pardalis* (Castelnau). Huallaga; Amazons and northward.  
*L. varius* Cope.  
 399. *Pt. jeanesianus* (Cope). Nauta.  
 400. *Pt. multiradiatus* (Hancock). Demarara.  
 401. *Pt. lituratus* (Kner). Guapore; Xingu; eastern Brazil.

97. **PSEUDANCISTRUS** Bleeker.

402. *Ps. barbatus* (Cuv. & Val.). La Mana; Surinam.  
 403. *Ps. guttatus* (Cuv. & Val.). Guiana.  
 404. *Ps. depressus* (Günther). Surinam.  
 405. *Ps. setosus* (Boulenger). Colombia.  
 406. *Ps. wertheimeri* (Steind.). Rio Mucuri.

98. **DELTURUS** Eigenm. & Eigenm.

407. *D. angulicauda* (Steind.). Rio Mucuri; ? Rio Parahyba.  
 408. *D. parahybæ* Eigenm. & Eigenm. Parahyba.

99. **HEMIPSILICHTHYS** Eigenm. & Eigenm.

409. *H. gobio* (Lütken). Rio Parahyba.

100. **ACANTHICUS** Spix.

410. ? *A. vicinus* (Castelnau). Ucayale.  
 411. *A. hystrix* (Spix). Amazons.  
 412. *A. genibarbis* (Cuv. & Val.). ?—

## 101. CHÆTOSTOMUS Kner.

413. *C. jellakii* Steind. Amable Maria; Monterico.  
414. *C. latifrons* Günther. Marañon.  
415. *C. macrops* Lütken. Surinam.  
416. *C. stannii* Kröyer. Puerto Cabello; Mamoni.  
417. *C. tackzanowskii* Steind. Rio de Tortara; Rio de Huambo.  
418. *C. tectirostris* Cope. Ambyiacu.  
419. *C. variolus* Cope. Ambyiacu.  
420. *C. medirostris* Lütken. Venezuela.  
421. *C. guairensis* Steind. Guaire; Caracas.  
422. *C. sericeus* Cope. Ambyiacu.  
423. *C. malacops* Cope. Ambyiacu.  
424. *C. branickii* Steind. Callacate, Peru; Rio de Huambo.  
425. *C. fischeri* Steind. Mamoni.  
426. *C. lobarhynchus* Tschudi. Tullumayo.  
427. *C. dermorhynchus* Boulenger. Canelos.  
428. *C. microps* Günther. Canelos; Rio de Huambo; western Ecuador.  
429. *C. nudiceps* (M. & T.). British Guiana.  
430. *C. erinaceus* (Cuv. & Val.). Chili.  
431. *C. bufonius* (Cuv. & Val.). Apurimac.  
432. *C. gymnorhynchus* (Kner). Puerto Cabello.  
*H. korsteni* Kröyer.

## 102. ANCISTRUS Kner.

433. *A. chagresi* Eigenm. & Eigenm. Rio Chagres.  
434. *A. stigmaticus* Eigenm. & Eigenm. Goyaz.  
435. *A. cirrhosus* (Valenciennes). La Plata to Guiana.  
435a. *A. cirrhosus dubius* Eigenm. & Eigenm. Gurupa; Tabatinga.  
436. *A. leucostictus* (Günther). Coary; Tabatinga; Jutahy; Huallaga; Ambyiacu.  
437. *A. hoplogenyis* (Günther). River Capin; Tajapurú.  
438. *A. temminkii* (Cuv. & Val.). Surinam; Amazons.  
*A. dolichopterus* Kner.  
439. *A. calamita* (Cuv. & Val.). Apurimac.

## XIII. CALLICHTHYIDÆ.

## 103. SCLEROMYSTAX Günther.

440. *S. barbatus* Quoy & Gaimard. Rio Janeiro.

## 104. CALLICHTHYS Linnaeus.

*Cataphractus* Bloch, preoccupied in Mam.

441. *C. callichthys* Linnaeus. La Plata to Trinidad.  
*C. lamoata* L.; *C. asper* Quoy & Gaimard; *C. depressa* Swainson; *C. ovalatus* Cuv. & Val.; *C. lviceps* Cuv. & Val.; *C. loricatus* Gronow; *C. kneri* Gill;  
*C. affinis* Günther; *C. hemiphractus* Hensel.  
442. *C. arcifer* Hensel. Rio de Janeiro.

105. HOPLOSTERNUM Gill.

443. *H. littorale* (Hancock). La Plata to Trinidad.  
*C. subulatus* Cuv. & Val.; *C. lavigatus* Valenciennes; *C. albidus* Cuv. & Val.;  
*H. stevardii* Gill.
444. *H. thoracatum* (Cuv. & Val.). Amazons and northward.  
*C. longifilis* Cuv. & Val.; *C. personatus* Ranzani; *C. exaratus* and *pictus* M. &  
T.; *C. sulcatus* Kner; *C. chiquitos* Castelnau.
445. *H. melampterum* (Cope). Ambyiacu.

106. DECAPOGON Eigenm. & Eigenm.

446. *Dec. adpersum* Steind. Porto do Moz; Cudajas; Tabatinga.

107. DIANEMA Cope.

447. *Di. longibarbis* Cope. Ambyiacu.

108. BROCHIS Cope.

§ ? nov.

448. *B. taioah* (Castelnau). —?

§ *Chanothorax* Cope.

449. *B. bicarinatus* (Cope). Marañon.
450. *B. semiscutatus* (Cope). Ambyiacu.

§ *Brochis* Cope.

451. *B. dipterus* Cope. Ambyiacu.
452. *B. cœruleus* Cope. Ambyiacu.

109. CORYDORAS Lacépède.

*Hoplisoma* Swainson; *Hoplosoma* Gill; *Gasterodermus* Cope.

453. *C. eques* Steind. Solimoens.
454. *C. splendens* (Castelnau). Tocantins.
455. *C. elegans* Steind. Cudajas; Teffé.
456. *C. nattereri* Steind. Rio Janeiro to Rio Doce.
457. *C. sœneus* (Gill). Trinidad.
458. *C. armatus* (Günther). Marañon and tributaries.
459. *C. paleatus* (Jenyns). La Plata and tributaries.  
*Corydoras marmoratus* Steind.; *Callichthys punctatus* Val. and Cuv. & Val.
460. *C. punctatus* (Bloch). Guiana; Solimoens; Marañon.  
*Corydoras geoffroy* Lacépède; *Corydoras ambiacus* Cope.
461. *C. trilineatus* Cope. Ambyiacu.  
*Corydoras agassizii* Steind.
462. *C. acutus* Cope. Ambyiacu.
463. *C. amphibelus* Cope. Ambyiacu.
464. *C. hastatus* Eigenm. & Eigenm. Villa Bella.

## EVENTOGNATHI.

## XIV. CHARACINIDÆ.

## ERYTHRININÆ.\*

## 110. MACRODON Müller.

465. *M. microlepis* Günther. Rio Chagres; Guayaquil. Eigenm. & Eigenm., 102.  
466. *M. malabaricus* (Bloch). Eastern slopes of South America from La Plata to Rio Magdalena and Huallaga. Eigenm. & Eigenm., 102.  
*Synodus tarcira* Bl. & Schn.; *Erythrinus trahira* Spix; *E. macrodon* Agassiz; *E. microcephalus* Agassiz; *E. brasiliensis* Spix; *Macrodon guarina* Val.; *M. auritus*, *teres*, *patana*, and *aimara* Cuv. & Val.; *M. ferox* Gill; *M. intermedius* Günther.

## 111. ERYTHRINUS Gronow.

*Hetererotherinus* Günther.

467. *E. unitæniatus* Spix. Rio Parahyba to Guiana and Peru; Trinidad. Eigenm. & Eigenm., 105.  
*E. vittatus* Cuv. & Val.; *E. cinereus* Gill; *E. kessleri* Steind.  
468. *E. salvus* Agassiz. San Francisco; Guiana; Orinoco. Eigenm. & Eigenm., 105.  
*E. gronowii* Cuv. & Val.  
469. *E. erythrinus* (Bloch & Schneider). Rio Janeiro to Surinam and Peru. Eigenm. & Eigenm., 105.  
*E. salmonæus* Gronow; *E. brevicauda* Günther.  
470. *E. longipinnis* Günther. Essequibo. Eigenm. & Eigenm., 105.

## 112. PYRRHULINA Cuv. &amp; Val.

*Holotaxis* Cope.

471. *P. melanostoma* (Cope). Marañon. Eigenm. & Eigenm., 108.  
472. *P. læta* (Cope). Ambyiacu. Eigenm. & Eigenm., 108.  
473. *P. filamentosa* Cuv. & Val. Guianas. Eigenm. & Eigenm., 109.  
474. *P. semifasciata* Steind. Amazons from Gurupa to Tabatinga. Eigenm. & Eigenm., 109.  
475. *P. brevis* Steind. Amazons from Obidos to Tabatinga. Eigenm. & Eigenm., 109.  
476. *P. maxima* Eigenm. & Eigenm. Tabatinga. Eigenm. & Eigenm., 109.  
477. *P. nattereri* Steind. Amazons from Obidos to Cudajas. Eigenm. & Eigenm., 109.  
478. *P. guttata* Steind. Amazons from Gurupa to Tabatinga; Rio Negro. Eigenm. & Eigenm., 109.  
479. *P. argyrops* Cope. Marañon. Eigenm. & Eigenm., 109.

## 113. LEBIASINA Cuv. &amp; Val.

480. *L. bimaculata* Cuv. & Val. Western slopes of Peru and Ecuador; Callao Bay.

\* See Eigenm. & Eigenm., '89a. This paper only is referred to for description of species.



114. **STEVARDIA** Gill.

§ *Stevardia*.

481. *S. albipinnis* Gill. Trinidad. Eigenm. & Eigenm., 114.

§ *Corynopoma* Gill.

482. *S. riisei* Gill. Trinidad. Eigenm. & Eigenm., 114.

483. *S. veedonli* Gill. Trinidad. Eigenm. & Eigenm., 114.

§ *Nematopoma* Gill.

484. *S. searlesii* Gill. Trinidad. Eigenm. & Eigenm., 114.

CURIMATINÆ.\*

115. **ELOPOMORPHUS** Gill.

485. *A. melanopogon* Cope. Marañon. Eigenm. & Eigenm., 3.

486. *A. steatops* Cope. Marañon. Eigenm. & Eigenm., 3.

487. *A. elongatus* Spix. Amazons. Eigenm. & Eigenm., 3.  
*Elopomorphus jordani* Gill.

116. **POTAMORHINA** Cope.

488. *P. pristigaster* Steind. Amazons from the Rio Negro to Peru. Eigenm. & Eigenm., 3

117. **PSECTROGASTER** Eigenm. & Eigenm.

489. *Ps. rhomboides* Eigenm. & Eigenm. Rio Puty. Eigenm. & Eigenm., 4.

490. ? *Ps. amazonica* Eigenm. & Eigenm. Amazons. Eigenm. & Eigenm., 5.

491. *Ps. ciliata* Müller & Troschel. Amazon. Guiana. Eigenm. & Eigenm., 5.

118. **CURIMATOPSIS** Steindachner.

492. *C. macrolepis* Steind. Amazons. Eigenm. & Eigenm., 6.

493. *C. microlepis* Eigenm. & Eigenm. Jatuarana. Eigenm. & Eigenm., 6.

119. **CURIMATUS** Cuvier.

*Semitapcis* Eigenm. & Eigenm.

§ *Curimatella* Eigenm. & Eigenm.

494. *C. lepidurus* Eigenm. & Eigenm. Rio San Francisco. Eigenm. & Eigenm., 9.

495. *C. meyeri* Steind. Amazons. Eigenm. & Eigenm., 7 and 10.

496. *C. serpæ* Eigenm. & Eigenm. *Serpa* Eigenm. & Eigenm., 7 and 10.

497. *C. alburnus* Müller & Troschel. Northern Brazil and northward. Eigenm. & Eigenm., 7 and 10.

- 497a. *C. alburnus lineatus* Eigenm. & Eigenm. Jutahy. Eigenm. & Eigenm., 7 and 10.

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\* The edentulous genera of Curimatinae have lately been revised by us (Eigenm. & Eigenm., '89 b) and only our revision is referred to here. *Annals New York Academy of Science*, iv, Nov., 1889. It includes the genera *Elopomorphus*, *Potamorkina*, *Psectrogaster*, *Curimatopsis*, and *Curimatus*.

§ *Curimatus*.

498. *C. spilurus* Günther. Amazons and northward. Eigenm. & Eigenm., 7 and 10.
499. *C. spiluropsis* Eigenm. & Eigenm. Iça. Eigenm. & Eigenm., 7 and 10.
500. *C. dorsalis* Eigenm. & Eigenm. Amazon and Solimoens. Eigenm. & Eigenm., 7 and 12.
501. *C. nasus* Steind. Canelos, Ecuador. Eigenm. & Eigenm., 7 and 13.
502. *C. troscheli* Günther. Western slopes of Ecuador. Eigenm. & Eigenm., 7 and 13.
503. *C. elegans* Steind. Southeastern Brazil. Eigenm. & Eigenm., 7 and 13.
- 503a. *C. elegans bahiensis* Eigenm. & Eigenm. Bahia. Eigenm. & Eigenm., 8 and 13.
504. *C. argenteus* Gill. Trinidad. Eigenm. & Eigenm., 8 and 13.
505. *C. bimaculatus* Steind. Amazon; Solimoens. Eigenm. & Eigenm., 8 and 14.
- 505a. *C. bimaculatus sialis* Eigenm. & Eigenm. Manacapuru. Eigenm. & Eigenm., 8 and 14.
- 505b. *C. bimaculatus trachystethus* Cope. Amazons. Eigenm. & Eigenm., 8 and 14.
506. *C. dobula* Günther. Eastern slopes of Peru and Ecuador. Eigenm. & Eigenm., 8 and 15.
507. *C. güntheri* Eigenm. & Eigenm. Tabatinga. Eigenm. & Eigenm., 8 and 15.
508. *C. microcephalus* Eigenm. & Eigenm. Surinam. Eigenm. & Eigenm., 8 and 15.
509. *C. magdalenæ* Steind. Magdalena system; Panama. Eigenm. & Eigenm., 8 and 16.
510. *C. gilberti* Quoy & Gaimard. Southeastern Brazil. Eigenm. & Eigenm., 8 and 16.
- C. voga* Hensel; *C. albula* Lütken.
- 510a. *C. gilberti brevipinnis* Eigenm. & Eigenm. La Plata. Eigenm. & Eigenm., 8 and 16.
511. *C. plumbeus* Eigenm. & Eigenm. Lake Hyanuary. Eigenm. & Eigenm., 8 and 17.
512. *C. nagelli* Steind. Rio Janeiro. Eigenm. & Eigenm., 8 and 17.
513. *C. leucostictus* Eigenm. & Eigenm. Rio Negro; Lago Alexo. Eigenm. & Eigenm., 8 and 17.
514. *C. alberti* Günther, '80a, 12. Eigenm. & Eigenm., 2.
515. *C. platanus* Günther. La Plata. Eigenm. & Eigenm., 8 and 18.
516. *C. asper* Günther. Xeberos; Huallaga. Eigenm. & Eigenm., 8 and 18.
517. *C. rutiloides* Kner. Amazons and tributaries. Eigenm. & Eigenm., 8 and 18.
518. *C. hypostomus* Boulenger. Ucayale. Eigenm. & Eigenm., 8 and 18.
519. *C. mivartii* Steind. Magdalena. Eigenm. & Eigenm., 8 and 18.
520. *C. leuciscus* Günther. Amazons. Eigenm. & Eigenm., 8 and 18.
521. *C. vittatus* Kner. Amazon and Solimoens. Eigenm. & Eigenm., 8 and 19.
522. *C. ocellatus* Eigenm. & Eigenm. Xingu. Eigenm. & Eigenm., 9 and 19.
523. *C. isognathus* Eigenm. & Eigenm. San Paolo; Amazon and Solimoens. Eigenm. & Eigenm., 9 and 20.
524. *C. kneri* Steind. Amazon; Solimoens and Surinam. Eigenm. & Eigenm., 9 and 20.

525. *C. cyprinoides* (Linnaeus). Amazons; Guianas. Eigenm. & Eigenm., 9 and 21.  
 526. *C. macrops* Eigenm. & Eigenm. Rio Puty. Eigenm. & Eigenm., 9 and 21.  
 527. *C. falcatus* Eigenm. & Eigenm. Gurupa; Xingu. Eigenm. & Eigenm., 9 and 22.  
 528. *C. simulatus* Eigenm. & Eigenm. Fontebos; Tocantins. Eigenm. & Eigenm., 9 and 22.  
 529. *C. schomburgkii* Günther. Guianas. Eigenm. & Eigenm., 9 and 22.  
 530. *C. essequibensis* Günther. Essequibo. Eigenm. & Eigenm., 9 and 23.

§ *Anodus* Spix.

531. *C. planirostris* Gronow. Amazon; Rio Negro. Eigenm. & Eigenm., 9 and 23.  
*C. abramoides* Kner.  
 532. *C. laticeps* Cuv. & Val. Amazons. Eigenm. & Eigenm., 9 and 24.  
*C. altamazonicus* Cope.  
 533. *C. latior* (Spix). Amazons; Surinam. Eigenm. & Eigenm., 9 and 24.

120. *PROCHILODUS* Agassiz.

*Pacu* Spix.

534. *P. humeralis* Günther. Western Andes of Ecuador. G., v, 294.  
 535. *P. vimboideus* Heckel. Southeastern Brazil. G., v, 294.  
 536. *P. cephalotes* Cope. Peruvian Amazon. Cope, '78, 686.  
 537. *P. argenteus* Agassiz. Rio Cipo; Rio San Francisco; Rio das Velhas. G., v, 294.  
*P. costatus* Cuv. & Val.  
 538. *P. affinis* Lütken. Rio das Velhas and tributaries. Lütk., '75, 189.  
 539. *P. nigricans* Agassiz. Amazons († Rio Plata system, Weyenbergh), not of Günther. Steind., '81, 32.  
 540. *P. rubrotæniatus* Schomburgk. Cauca; Essequibo; Negro and its tributary Branco; Upper Amazon. G., v, 295, as *nigricans*.  
 541. *P. oligolepis* Günther. Brazil. G., v, 295.  
*P. nigricans*. Kner, not of Agassiz.  
 542. *P. asper* Lütken. Caracas; Cauca. L., '74, 226.  
 543. *P. magdalenæ* Steind. Rio Magdalena. Steind., '78, 35.  
 544. *P. lineatus* Valenciennes. Lower La Plata system. G., v, 295.  
 545. *P. dobulinus* Cuv. & Val. Amazons. G., v, 296.  
 546. *P. brama* Cuv. & Val. Lower Tocantins; Calabozo. G., v, 296.  
 547. *P. insignis* Schomburgk. Amazons and tributaries; Guiana. G., v, 296.  
 548. *P. binotatus* Schomburgk. Rio Branco; Rio Negro. G., v, 296.  
 549. *P. tæniurus* Valenciennes. Amazons. G., v, 297.  
 550. *P. brevis* Steind. Rivers near Bahia. Steind., '74, 38, Pl. vi.  
 551. *P. ortonianus* Cope. Peruvian Amazon. Cope, '78, 685.  
 552. *P. hartii* Steind. Rios Jequitinhonha, Parahyba, and Pardo. Steind., '74, 35, Pl. v.  
 553. *P. laticeps* Steind. Orinoco, near Ciudad, Bolivar. Steind., '79, 4.  
 554. *P. longirostris* Steind. Cauca. Steind., '79b, 70.  
 555. *P. scrofa* Steind. Rio Janeiro. Steind., '81, 29.

121. **CHILODUS**\* Müller & Troschel.

*Microdus* Kner; *Cænotropus* Günther.

556. *C. labyrinthicus* (Kner). Amazon and tributaries; Orinoco. G., v, 297.

557. *C. punctatus* Müller & Troschel. Savanna swamps of British Guiana. G., v, 297.

122. **HEMIODUS** Müller & Troschel.

558. *H. notatus* (Schomburgk). Guianas; Rios Trombetas, Araguay, Negro, and Guapore. G., v, 298.

559. *H. kappleri* Günther. Surinam. '68a, 244.

560. *H. microcephalus* Günther. Rio Capin. G., v, 298.

561. *H. amazonum* Humboldt. Amazons. G., v, 298.

*P. humboldtii* Cuv. & Val.

562. *H. unimaculatus* (Bloch). All rivers of British Guiana; Cujaba. G., v, 299.  
*H. crenidens* Müller.

563. *H. gracilis* Günther. Rio Cupai; Rio San Francisco. G., v, 299.

564. *H. semitæniatus* Kner. Rio Guapore. G., v, 299.

565. *H. immaculatus* Kner. Barra do Rio Negro; Orinoco. G., v, 300.

566. *H. longiceps* Kner. Rio Içanno; Rio Capin. G., v, 300.

567. *H. microlepis* Kner. Rio Guapore; Barra do Rio Negro; Peruvian Amazon.

123. **SACCODON** Kner.

568. *S. wagneri* Kner & Steind. Ecuador. G., v, 301.

569. *S. craniocephalum* Thominot. Rio Guayaquil. T. '82, 248.

124. **PARODON** Cuvier & Valenciennes.

570. *P. suborbitalis* Cuv. & Val. Maracaibo; Amazon; Rio das Velhas. G., v, 301.

*P. nasus* Kner. *P. hilarii* Reinhardt.

571. *P. buckleyi* Boulenger. † Canelos. B. '87, 279.

572. *P. affinis* Steind. La Plata. Steind., '79a, 20, Pl. III, Fig. 3.

## ANOSTOMATINÆ.

125. **NANNOSTOMUS** Günther. †

573. *N. beckfordi* Gthr. Demarara. G., '72, 146.

574. *N. trifasciatus* Steind. Barra do Rio Negro; Tabatinga, '76, 75, Fig. 2.

575. *N. eques* Steind. Peruvian Amazon '76, 78, Fig. 3.

576. *N. unifasciatus* Steind. Barra do Rio Negro '76, 79, Fig. 1.

577. *N. anamolis* Steind. Obidos; Barra do Rio Negro, '76, 81.

\* Dr. Günther states that *Chilodus* is preoccupied, without stating where. We have not found any earlier use of the name in this form, and reinstate it here.

† Dr. Boulenger gives a key to the species of the genus *Parodon*.

‡ For an account of this genus see Steindachner, Ichthyologische Beiträge, v, pp. 74-82, Pl. ix, 1876.

126. *ANOSTOMUS* Gronow.\*§ *Anostomus* Gronow.

578. *A. anostomus* (Linnaeus). Essequibo; Jutahy. G., v, 303.  
*A. salmonens* Gronow.
579. *A. trimaculatus* (Kner). Matogrosso; Marañon; Gurnpa. G., v, 304.

§ *Schizodon* Agassiz.

580. *A. vittatus* (Cuv. & Val.). La Plata; Araguay; Goyaz; Porto do Moz. G., v, 303.
581. *A. gracilis* (Kuer). Rio Guapore. G., v, 304.
582. *A. fasciatus* (Agassiz). Amazons; British Guiana; Caracas. G., v, 304.  
*P. schizodon* Cuv. & Val.
583. *A. dissimilis* Garman. Rio Puty. '90, 22.
584. *A. isognathus* (Kner). Cujaba; Rio San Francisco; Rio Grande do Sul. G., v, 305.  
*A. knerii* Steind.
585. *A. platæ* Garman. Rosario, La Plata. '90, 26.
586. *A. nasutus* (Kner). Irisanga; Rio Puty. G., v, 305.
587. *A. sagittarius* (Cope). Marañon. Cope, '78, 689.

127. *LÆMOLYTA* Cope.*Schizodontopsis* Garman.

588. *L. tæniata* (Kner). Amazons. G., v, 304.
589. *L. proximus* (Garman). Villa Bella; Ueranduba. '90, 19.
590. *L. varius* (Garman). Amazons. '90, 20.
- 590a. *L. varius nitens* (Garman). Iça. '90, 20.
591. *L. orinocensis* Steind. Orinoco. '79, 6, Pl. II, Fig. 7-7a.

128. *CHARACIDIUM* Reinhardt.

592. *C. fasciatum* Reinhardt. Rio Parahyba; Rio Piabanha; Rio das Velhas; Sarayacu; Orinoco. Lütken, '75, 194, Figs. 1 and 2.
593. *C. steindachneri* Cope. Peruvian Amazon. Cope, '78, 688.
594. *C. etheostoma* Cope. Ambyiacu. Cope, '72, 259, Pl. VIII, Fig. 1, and Pl. XIII, Fig. 3.
595. *C. purpuratum* Steind. Canelos, Ecuador. Steind., '82a, 18.

129. *RHYTIODUS* Kner.

596. *R. microlepis* Kner. Barra do Rio Negro. G., v, 305.
597. *R. argenteofuscus* Kner. Rio Negro. G., v, 306.

130. *LEPORELLUS* Lütken.

598. *Lep. vittatus* (Cuv. & Val.). Rio das Velhas; Irisanga; Marañon; Araguay; Goyaz; Cauca. Lütken, '75, 201, XI.  
*L. maculifrons* Reinhardt; *Leporinus pictus* Kner.
599. *Lep. nattereri* Steind. Teffé; Lago Alexo; Barra do Rio Negro. Steind., '76, 66.

\* For an excellent account of this genus see Garman, '90a.

## 131. LEPORINUS Spix.

600. *L. maculatus* Müller & Troschel. Guiana; Goyaz. G., v, 306.
601. *L. frederici* (Bloch). Eastern rivers from the Orinoco to the La Plata, ascending Amazonas to Peru. G., v, 306.  
*L. acutidens* Val.
602. *L. obtusidens* Val. La Plata; Rio Grande do Sul; Rio San Francisco; Magdalena. G., v, 306.  
*L. elongatus* Cuv. & Val.
603. *L. megalepis* Günther. Essequibo to Rio Janeiro; Xeberos and Ambyiacu. G., '63, 443.  
*L. maroegravii* Reinhardt.
604. *L. reinhardtii* Lütken. Rio das Velhas. Lütken, '75, 197, Pl. iv, Fig. 10.  
*L. affinis* Reinhardt.
605. *L. leschenaultii* Cuv. & Val. Rio Capin; Calabozo; Andes of western Ecuador. G., v, 307.
606. *L. bimalaculatus* Castelnau. Rio Vermelho de Goyaz. G., v, 308.
607. *L. fasciatus* (Bloch). Rio Cupai; Guiana; Orinoco; Calabozo. G., v, 308.  
*L. novemfasciatus* Spix.
608. *L. trifasciatus* Steind. Teffé; Huallaga. Steind., '76, 64.
609. *L. affinis* Günther. Orinoco; Capin; Jequitinhonha.
610. *L. pachyurus* Cuv. & Val. Rio Cipo; Rio Araguay. G., v, 308.
611. *L. margaritaceus* Günther. British Guiana. G., v, 309.
612. *L. mülleri* Steind. Marañon; Solimoens; Orinoco. Steind., '76, 57, Pl. ix, Fig. 5.
613. *L. nigrotæniatus* (Schomburgk). Guiana; Rio Negro, and the Amazon near Rio Negro. G., v, 309.
614. *L. melanopleura* Günther. Bahia; Rio Cipo.
615. *L. striatus* Kner. Rio Magdalena; Canelos, Ecuador; Irisanga and Caiçara in Mattogrosso; Paraguay. G., v, 310.
616. *L. agassizii* Steind. Solimoens; Iça. Steind., '76, 59, Pl. ix, Fig. 4.
617. *L. hypselonotus* Günther. Orinoco; Marañon; Xeberos. G., '68a, 244, Pl. xxii.
618. *L. eques* Steind. Rio Magdalena. Steind., '78, 40, Pl. x, Figs. 2-2a.
619. *L. tæniatus* Reinhardt. Rio das Velhas. Lütken, '75, 199, Pl. iv, Fig. 11.
620. *L. macrolepidotus* Peters. Rio Janeiro. '68, 455.
621. *L. multifasciatus* Cope. Marañon. '78, 690.
622. *L. holostictus* Cope. Marañon. *loc. cit.*
623. *L. mormyrus* Steind. Upper Parahyba and its tributary Piabanha. '75b, 30, Pl. vi.
624. *L. bahiensis* Steind. Bahia. '75b, 21, Pl. ii, Fig. 2.
625. *L. copelandi* Steind. Southeastern Brazil. '75b, 26, Pl. v.
626. *L. conirostris* Steind. Southeastern Brazil. '75b, 23, Pl. iv.

## TETRAGONOPTERINÆ.

## 132. PLETHODECTES Cope.

627. *P. erythrinus* Cope. Pebas, Ecuador. '70, 563, Fig.

## 133. PIABUCINA Cuv. &amp; Val.

628. *Pi. erythrinoides* Val. Maracaibo. G., v, 311.  
 629. *Pi. unitæniata* Günther. Canelos, Ecuador; Guiana. G., v, 311.  
 630. *Pi. panamensis* Gill. Rio Frijoli. '76, 336.  
 631. *Pi. elongata* Boulenger. Canelos; Sarayacu. '87, 280, Pl. x XIII, Fig. 2.

## 134. IGUANODECTES Cope.

632. *I. tenuis* Cope. Ambyacu. '72, 260, Pl. VIII, Fig. 1.

## 135. TETRAGONOPTERUS Cuvier.

*Asyanax* Baird & Girard; *Pætilurichthys* Gill; *Hemigrammus* Gill.

633. *T. spilurus* Cuv. & Val. Surinam. G., v, 318.  
 634. *T. argenteus* Cuv. Orinoco; Amucu; Cujaba; Amazon; Iquitos. G., v, 318.  
 635. *T. gibbosus* Steind. Rio Parahyba. Steind. '76a, 4, Pl. I, Fig. 1.  
 636. *T. rufipes* Val. Buenos Ayres. G., v, 318.  
 637. *T. artedii* Cuv. & Val. ? Hab. G., v, 319.  
 638. *T. doceanus* Steind. Rio Doce. Steind. '76a, 14.  
 639. *T. polylepis* Günther. British Guiana. G., v, 320.  
 640. *T. chalcus* Agassiz. Surinam; Essequibo; Amazons from Porto do Moz to the Ambyacu. G., v, 320.  
*T. schomburgkii* Cuv. & Val.  
 641. *T. orbicularis* Cuv. & Val. La Plata; Rio Parahyba; Amazon; Marañon; Essequibo; Surinam; Villa Maria. G., v, 319, 320.  
*T. compressus* Günther.  
 642. *T. brevisrostris* Günther. Western Andes of Ecuador. G., v, 321.  
 643. *T. abramis* Jenyns. La Plata and Rio Parana; Essequibo; Orinoco. G., v, 321.  
 644. *T. lacustris* Reinhardt. Rio das Velhas; Lütken, '75, 208, Pl. v, Fig. 15.  
 645. *T. maculatus* (Linnaeus). Magdalena; Orinoco; British Guiana; Rio Capin; Pernambuco; Bahia; Rios Parahyba, Doce, and Mucuri; Rio Grande do Sul. G., v, 321.  
*S. bimaculata* L.; *T. linnæi* Cuv. & Val.; *T. gronovii* Cuv. & Val.; *T. rittatus* Castelnau; *T. microstoma* Hensel.  
 646. *T. bahiensis* Steind. Bahia. Steind. '76a, 13.  
 647. *T. fasciatus* Cuv. La Plata; Rio Grande do Sul; Rio Janeiro; Rio Parahyba; Rio Jequitinhonha. Steind., '76a, 20, Pl. I, Fig. 3 (not G., v, 322).  
*T. rivularis* Lütken; *T. obscurus* Hensel.  
 648. *T. rutilus* Jenyns. Cauca; Canelos, Ecuador; Rio San Francisco to Rio Plata (Xamapa, Mexico). G., v, 322, as *fasciatus*.  
*T. fasciatus* Val., Gthr. not Cuvier; *T. scabripinnis* Kner not Jenyns; *T. microstoma* Günther; ? *T. fuscoauratus* Castelnau; *T. æneus* Hensel; *T. currieri* Lütken; *T. tenuatus* Jenyns.  
 648a. *T. rutilus jequitinhonhae* Steind. Rio Jequitinhonha. Steind., '76a, 27, Pl. II, Fig. 3.  
 649. *T. microphthalmus* Günther. Rio Rimac; Lake Amatitlan; Pacific coast of Guatemala. G., v, 324.  
 650. *T. panamensis* Günther. Panama; Yzabal. G., v, 324.  
*T. fischeri* Steind.

651. *T. dichrourus* Kner. Rio Guapore; Caicara; Paraguay. G., v, 324.  
652. *T. scabripinnis* Jenyns. Rio Janeiro; Irisanga; (Xamapa, Mexico). G., v, 326.  
653. *T. jenynsii* Steind. Rio Parahyba. '76a, 22, Pl. III, Figs. 1 and 2.  
654. *T. petenensis* Günther. Rio Negro, Argentine Republic; Lake Peten; western Ecuador. G., v, 326.  
655. *T. æneus* Günther. Rio Cadeo; Porto Alegre; Bahia Soldado; Rio Chagres; (Rio Frijoli; Oaxaca). G., v, 326.  
656. *T. wappi* Cuv. & Val. British Guiana. G., v, 326.  
657. *T. peruvianus* Müller & Troschel. Pascamayo, Peru. G., v, 327.  
658. *T. oligolepis* Günther. British Guiana. G., v, 327.  
659. *T. chrysargyreus* Günther. Essequibo. G., v, 328.  
660. *T. grandisquamis* Müller & Troschel. British Guiana. G., v, 328.  
661. *T. lepidurus* Kner. Amazons from Obidos to Tabatinga; Guapore.  
662. *T. xinguensis* Steind. Xingu. Steind., '82, 32.  
663. *T. huam bonicus* Steind. Callacate and Rio Huambo, Peru. '82, 25, Pl. v, Fig. 1.  
664. *T. polyodon* Günther. Guayaquil. G., v, 330.  
665. *T. trinitatis* Lütken. Trinidad. '74, 234.  
666. *T. tæniurus* Gill. Trinidad. Lütken, '74, 233.  
667. *T. brevoortii* Gill. Trinidad. Lütken, '74, 232.  
668. *T. sawa* Castelnau. Rio Crixas. G., v, 317.  
669. *T. viejita* Cuv. & Val. Lake Maracaibo. G., v, 317.  
670. *T. orbignyanus* Cuv. & Val. Buenos Ayres. G., v, 317.  
671. *T. agassizii* Steind. Tabatinga; Cudajas. '76, 41, Pl. VIII, Fig. 2.  
672. *T. alburnus* Hensel. Rio Cadeo. Steind., '76a, 24.  
673. *T. bairdii* Steind. Tabatinga. Steind., '82, 35.  
674. *T. bartletti* Günther. Marañon; Ambyacu. G., '66b, 30.  
675. *T. bellottii* Steind. Tabatinga. Steind., '82, 34.  
676. *T. branickii* Steind. Rio Zurumilla (boundary between Ecuador and Peru). '82, 21, Pl. I, Fig. 3.  
677. *T. carolinæ* Gill. Rio Napo or Marañon. '70, 92.  
678. *T. caucanus* Steind. Cauca. '80, 20, Pl. VI, Fig. 2.  
679. *T. colletti* Steind. Obidos; Hyavary. '82, 33, Pl. VII.  
680. *T. copei* Steind. Santarem. '82, 35, Pl. VI, Fig. 6.  
681. *T. cordovæ* Günther. Rio de Cordova. '80, 12.  
682. *T. diaphanus* Cope. Marañon. '78, 691.  
683. *T. elegans* Steind. Obidos. '82, 36, Pl. VII, Fig. 4.  
684. *T. gracilis* Reinhardt. Lagoa Santa; Rio das Velhas. Lütken, '75, 217, Pl. v, Fig. 16.  
685. *T. gronovii* Kner & Steind. Rio Bayano. '64, 46.  
686. *T. huxwellianus* Cope. Hyavary; Santarem; Pebas. '70, 560.  
687. *T. iheringii* Boulenger. Rio Grande do Sul. '87, 172.  
688. *T. ipanquianus* Cope. Urubamba; Marañon. '77, 44.  
689. *T. jelakii* Steind. Monterico; Huambo; Peru. '75c, 40.  
690. *T. longior* Cope. Marañon. '78, 691.  
691. *T. lütkenii* Boulenger. Rio Grande do Sul. '87, 173.



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694. *T. maximus* Steind. Tulumayo; Monterico. '75c, 43, Pl. VII.

*T. alosa* Günther.

695. *T. multiradiatus* Steind. Teffé. '76, 44.

696. *T. nanus* Reinhardt. Rio das Velhas. Lütken, '75, 218, Pl. v, Fig. 17.

697. *T. ocellifer* Steind. Villa Bella; Cudajas. '82, 32, Pl. VII, Fig. 5.

698. *T. orientalis* Cope. Para. '70, 559.

699. *T. ortonii* Gill. Marañon and Napo. '70, 92.

700. *T. ovalis* Günther. Xeberos. '68a, 245.

701. *T. pectinatus* Cope. Pebas. Cope, '70, 560.

702. *T. phœnicopterus* Cope. Ambyiacu. '72, 260.

703. *T. schmardæ* Steind. Tabatinga. '75c, IV, 37, Pl. VII, Fig. 6.

704. *T. stilbe* Cope. Para. '70, 559.

705. *T. tabatingæ* Steind. Tabatinga. '76, 43.

706. *T. unilineatus* Gill. Trinidad. '58, 420.

707. *T. robustulus* Cope. Pebas. '70, 561.

### 136. LÜTKENIA Steind.

708. *L. insignis* Steind. Santarem; Tabatinga. '75c, 38, Pl. VIII, Fig. 1.

### 137. SCISSOR Günther.

709. *S. macrocephalus* Günther. Surinam. G., v, 331.

### 138. HENOCHILUS Garman.

710. *H. wheatlandi* Garman. Rio Mucuri. Garman, '90a, 1.

### 139. PSEUDOCALCEUS Kner.

711. *Ps. lineatus* Kner. Western slopes of Ecuador. G., v, 332.

### 140. ODONTOSTILBE Cope.

712. *O. fugitiva* Cope. Pebas; Villa Bella; Santarem. '70, 566, with Fig.

713. *O. pulcher* Gill. Trinidad. '58, 419. Lütken, '74, 236.

### 141. CHEIRODON Girard.

714. *C. interruptus* (Jenyns). Maldonado. G., v, 332.

715. *C. pisciculus* Girard. Santiago. G., v, 332.

716. *C. agassizii* Steind. Jaturana. '82, 38.

717. *C. eques* Steind. Villa Bella; Obidos. Steind., '82, 37.

718. *C. insignis* Steind. Cauca; Panama; Villa Bella. '80, 22, Pl. VI, Fig. 3.

719. *C. nattereri* Steind. Obidos. '82c, 180.

720. *C. pequirá* (Natterer). Cujaba; Rio Guapore. Steind., '82, 38.

721. *C. piaba* Lütken. Rio das Velhas. '75, 219.

722. *C. pulcher* Steind.\* Villa Bella. Steind., '82, 39.

\* Should *Odontostilbe* Cope prove to be a subgenus of *Cheirodon*, as is supposed by Lütken (Vidensk. Medd. Nat. For. Kjöb., 1874, 236), this species must be renamed as *Tetragonopterus pulcher* Gill, is placed by Lütken in the subgenus *Odontostilbe* Cope, viz.: *Chirodon* (*Odontostilbe*) *pulcher* (Gill) Lütken, loc. cit. We would suggest the name *steindachneri* for this species.

142. **APHIOCHARAX** Günther.

723. *A. pusillus* Günther. Marañon and tributaries. '68a, 245.  
724. *A. alburnus* Günther. Marañon. '69, 424, Fig. 2.  
725. *A. filigerus* Cope. Pebas, Ecuador. '70, 564.

143. **CHALCEUS** Cuvier.

726. *C. macrolepidotus* Cuvier. Guiana; Rio Cupai; Ambyiacu. G., v, 333.  
727. *C. erythrurus* Cope. Ambyiacu. '72, 262.

144. **BRYCON** Müller & Troschel.

728. *B. schomburgkii* M. & T. Essequibo. G., v, 333.  
729. *B. orbignyanus* (Cuv. & Val.). Rio Plata; Guapore. G., v, 333.  
730. *B. rodopterus* (Cuv. & Val.). Buenos Ayres. G., v, 333.  
731. *B. devillei* (Castelnau). Bahia; Rio Parahyba; Rio Jequitinhonha. Steind., '76a, 29, Pl. iv, Figs. 2-2a.  
*B. insignis* Steind.  
732. *B. opalinus* (Cuvier). Brazil. G., v, 334.  
! *C. amazonicus* Agassiz.  
733. *B. nattereri* Günther. Irisanga. G., v, 334.  
734. *B. bahiensis* Günther. Bahia. G., v, 334.  
735. *B. falcatus* Müller & Troschel. Guiana. G., v, 334.  
736. *B. orthotænia* Günther. Rio Cipo; La Plata. G., v, 335.  
738. *B. brevicauda* Günther. Rio Jocintins; Rio Capin. G., v, 335.  
739. *B. atricaudatus* (Kner). Western Andes of Ecuador. G., v, 336.  
740. *B. carpophagus* (Cuv. & Val.). Guiana; Brazil. G., v, 336.  
741. *B. hilarii* (Cuv. & Val.). Brazil. G., v, 336.  
742. *B. pesu* (Müller & Troschel). Lower Essequibo; Mazaruni, Guiana. G., v, 336.  
743. *B. capito* Cope. Ambyiacu. '72, 261.  
744. *B. chagrensis* Kner. Chagres. Steind., '76a, 32.  
*B. striatulus* Kner.  
745. *B. ferox* Steind. Rio Mucuri. '76a, 25, Pl. iv, Figs. 1-1a.  
746. *B. labiatus* Steind. Cauca. '80, 23, Pl. III, Fig. 1.  
747. *B. lineatus* Steind. La Plata. '66, 4, Pl. II.  
748. *B. longiceps* Steind. Orinoco near Ciudad Bolivar. '79, 8, Pl. I, Fig. 5.  
749. *B. lundii* Reinhardt. Rio das Velhas. Lütken, '75, 221.  
750. *B. moorei* Steind. Rio Magdalena system. '78, 42, Pl. v, Figs. 2-2b.  
751. *B. reinhardti* Lütken. Rio das Velhas; Rio Doce; Rio Parahyba; Rio Jequitinhonha. Steind., '76a, 27, Pl. III, Figs. 3-3a.  
752. *B. rubricauda* Steind. Cauca. '80, 25, Pl. VIII, Figs. 1-1a.  
753. *B. stübelsi* Steind. Iquitos; Rio Amazonas. '82, 13, Pl. I, Fig. 1.  
754. *B. stolzmanni* Steind. Chota, Peru. '79, 22, Pl. II, Fig. 6.

§ *Chalcinopsis* Kner.

755. *B. dentex* Günther. (Guatemala); Ecuador. G., v, 337.  
756. *B. striatulus* Kner. Panama. G., v, 337.  
757. *B. chagrensis* Kner. Rio Chagres. G., v, 338.  
758. *B. alburnus* Günther. Western Andes of Ecuador. G., v, 338.

§ *Megalobrycon* Günther.

759. *B. melanopteron* Cope. Ambyiacu. '72, 262.  
 760. *B. cephalus* Günther. Marañon. '69a, 423, Fig. 1.  
 761. *B. erythropteron* Cope. Ambyiacu. '72, 263.

145. *BRYCONOPS* Kner.

762. *B. alburnoides* Kner. Rio Gnapore. G., v, 339.  
*B. alburnus* Kner.  
 763. *B. lucidus* Kner. Rio Branco. G., v, 339.

146. *CREATOCHANES* Günther.

764. *C. melanurus* Bloch. Guiana; Obidos; Rio Tapajos. G., v, 329.  
 765. *C. affinis* Günther. British Guiana. G., v, 329.  
 766. *C. caudomaculatus* Günther. South America. G., v, 330.

147. *CREAGRUTUS* Günther.*Piabina* Lütken.

767. *Cr. mülleri* Günther. Canelos, Ecuador. G., v, 339.  
 768. *Cr. affinis* Steind. Cauca. '83, 17.  
 769. *Cr. peruana* Steind. Rio Huambo; Monterico, Peru. '75c, iv, 46.  
*C. nasutus* Günther.  
 770. *Cr. argentea* (Reinhardt). Rio das Velhas. Lütken, '75, 226, Fig. 1-2.

148. *CHALCINUS* Cuv. & Val.\**Triportheus* Cope.

771. *Ch. angulatus* Agassiz. Orinoco; Guiana; Amazons. G., v, 340.  
*Ch. nematurus* Kner; *Triportheus flavus* Cope; *C. trifurcatus* Castelnau; *Ch. mülleri* Fil.; *C. brachypoma* Cuv. & Val., not Günther; ? *C. rotundatus* Schomburgk.  
 771a. *Ch. angulatus curtus* Garman. Para; Arary. '90, 4.  
 771b. *Ch. angulatus vittatus* Garman. Amazon. '90, 4.  
 771c. *Ch. angulatus signatus* Garman. Rio Puty. '90, 4.  
 771d. *Ch. angulatus fuscus* Garman. Amazons. '90, 4.  
 772. *Ch. albus* (Cope). Amazons. '72, 264.  
*Ch. kneri* Steind. (adult).  
 773. *Ch. güntheri* Garman. Essequibo; San Francisco. '90, 4.  
 774. *Ch. pictus* Garman. Jutahy. '90, 5.  
 775. *Ch. auritus* Cuv. & Val. Rio Araguay. G., v, 341.  
 776. *Ch. elongatus* Günther. Orinoco; Amazons. G., v, 342.  
 777. *Ch. culter* Cope. Iça; Solimoens; Marañon. '72, 265, Pl. xiv, Fig. 3.  
 778. *Ch. magdalenæ* Steind. Magdalena; Cauca. '78, 44, Pl. xi, Figs. 1-2.  
 779. *Ch. paranensis* Günther. La Plata; Parana. '74, 454.

149. *GASTEROPELECUS* Gronow.

780. *G. sternicla* (Linnaeus). Essequibo; Amazons. G., v, 342.  
 781. *G. stellatus* Kner. Iquitos; Amazons; Rio Cujaba; Paraguay. G., v, 343.  
 ? *G. securis* Filippi.

\* For an account of the species of this genus see Garman, '90.

782. *G. strigatus* Günther. Manacapuru. G., v, 343.

783. *G. maculatus* Steind. Mamoni River, Panama. G., v, 343, and Steind., '79, 20, Pl. I, Fig. 4.

784. *G. fasciatus* Garman. Amazons. '90, 9.

785. *G. pectorosus* Garman. Amazons. '90, 9.

#### 150. PIABUCA Cuvier.

786. *P. argentinus* (Linnæus). Guiana; Brazil. G., v, 343.

*Trutta dentata* Koelreuter.

787. *P. spilurus* Günther. Rio Cupai. G., v, 344.

#### 151. PARAGONIATES Steind.

788. *Pa. alburnus* Steind. Tefé; Canelos. '76, 69, Pl. VIII, Fig. 3.

789. *Pa. mülleri* Steind. Obidos. '76, 72.

790. *Pa. microlepis* Steind. Rio Janeiro; Rio Macacos. '76a, III, 33.

#### 152. AGONIATES Müller & Troschel.

791. *A. halecinus* M. & T. Curuni. G., v, 344.

#### 153. LEPTAGONIATES Boulenger.

792. *L. steindachneri* Boulenger. Sarayacu. '87a, 282, Pl. XXIII, Fig. 3.

#### HYDROCYONINÆ.

#### 154. ANACYRTUS Günther.

793. *A. gibbosus* (Linnæus). Guiana; Amazons. G., v, 346.

*Epicyrus macrolepis* Kner.

794. *A. pauciradiatus* Günther. Amazons. G., v, 346.

795. *A. sanguineus* Cope. Ambyiacu; Marañon. '72, 266, Pl. IX, Fig. 1.

796. *A. tectifer* Cope. Pebas. '70, 565.

797. *A. himæsquamis* Cope. Marañon. '78, 686.

798. *A. knerii* Boulenger. Canelos. '87a, 282.

#### 155. ROESTES Günther.

*Lycodon* Kner.

799. *R. molossus* (Kner). Brazil. G., v, 347.

800. *R. alatus* Steind. Rio Magdalena. '78, 49.

#### 156. RHEBOIDES Günther.

801. *R. affinis* (Günther). Calabozo; Amazons. '68, 246.

*R. rubrivertex* Cope.

802. *R. myersi* Gill. Amazons south to Rio Puty. '70, 92.

803. *R. dayi* Steind. Rio Magdalena; Cauca. '78, 45.

804. *R. bicornis* Cope. Pebas. '70, 564.

805. *R. bonariensis* Steind. La Plata. '79a, 23, Pl. VIII, Fig. 1.

806. *R. xenodon* Reinhardt. Amazons; Rio das Velhas. Lütken, '75, 227.

807. *R. microlepis* Reinhardt. Brazil. G., v, 347.

808. *R. guatemalensis* Günther. Rio Chagres; (Huamuchal) G., v, 347.

## 157. CYNOPOTAMUS Kner.

809. *C. argenteus* (Val.). La Plata; Araguay. G., v, 348.  
 810. *C. humeralis* (Val.). La Plata; Goyaz; Sao Paulo; Rosario. G., v, 348.  
 811. *C. knerii* Steind. Cujaba; Rio Paraguay; Irisanga; Tabatinga. '78, 48.  
*C. humeralis* Kner, not Val.  
 812. *C. magdalenæ* Steind. Magdalena and Cauca. '78, 61, Pl. XII, Figs. 2-2a.  
 813. *C. amazonum* Günther. Xeberos. '68a, 246.  
 814. *C. gulo* Cope. Pebas. '70, 565.  
 815. *C. biserialis* Garman. Amazonas. '90, 14.

## 158. EXODON \* Müller and Troschel.

*Hystericodon* Günther.

816. *E. paradoxus* M. & T. Guiana; Crixas; Araguay; Amazon. G., v, 349.  
*E. exodon* Cuv. & Val.

## 159. SALMINUS Agassiz.

817. *S. hilarii* Cuv. & Val. Rio San Francisco; Amazon; Goyaz. G., v, 349.  
 818. *S. cuvieri* Cuv. & Val. Rio Cipo; Rio San Francisco; Rio das Velhas. G., v, 350, as *brevidens*.  
 819. *S. brevidens* (Cuvier). Parana; Rio Plata. G., v, 350, as *maxillosus*.  
*S. maxillosus* Cuv. & Val.  
 820. *S. orbignyanus* Cuv. & Val. Jacuhy. Cuv. & Val., XXII, 65.  
 821. *S. affinis* Steind. Cauca. '80, 28, Pl. VII, Figs. 2-2a.

## 160. OLIGOSARCUS Günther.

822. *O. argenteus* Günther. Brazil. G., v, 351.

## 161. XIPHORHAMPHUS Müller &amp; Troschel.

823. *X. falcistrostris* (Cuv.). Demerara; Rio Cupai; Marañon and tributaries. G., v, 354.  
 824. *X. falcatus* (Bloch). Guiana; Amazon. G., v, 354.  
 825. *X. microlepis* (Schomburgk). British Guiana; Rio Negro; Amazonas. G., v, 355.  
 826. *X. ferox* Günther. Essequibo. G., v, 355.  
 827. *X. pericoptes* Müller & Troschel. Brazil. G., v, 355.  
 828. *X. hepsetus* (Cuv.). Southeastern Brazil; Buenos Ayres. G., v, 356.  
*X. hepseticus* Castelnau; *X. jennysi* Günther.  
 829. *X. oligolepis* Steind. La Plata. '67, 339.  
 830. *X. macrolepis* Steind. Rio Jequitinhonha. '76a, 36.  
 831. *X. lacustris* Reinhardt. Rio das Velhas. Lütken, '75, 232.  
 832. *X. heterolepis* Cope. Marañon. '78, 687.  
 833. *X. anomalus* Steind. Cauca. '80, 32.  
 834. *X. abbreviatus* Cope. Marañon. '78, 687.

\* Dr. Günther, v, 349, states that the name *Exodon* is preoccupied. We have been unable to find the form *Exodon* used elsewhere, and it is retained here.

162. **XIPHOSTOMA** Spix.

835. *Xa. lucius* (Cuvier). — ? G., v, 357.  
836. *Xa. cuvieri* Spix. Guiana; Tocantins. G., v, 357.  
*Xa. oeryi* Castelnau.  
837. *Xa. ocellatum* Schomburgk. Guiana; Rio Negro. G., v, 357.  
838. *Xa. maculatum* Cuv. & Val. Xingu, near Porto do Moz; Rio Cnpai; Marañon. G., v, 357.  
*Xa. ludo* Cope.  
839. *Xa. hujeta* Cuv. & Val. Maracaibo. G., v, 358.  
840. *Xa. longipinne* Steind. Rio Negro. '76, 84.

163. **LUCIOCHARAX** Steind.

841. *L. inaeulptus*. Rios Magdalena, Cauca, and Mamoni. '78, 51, Pl. XIII, Figs. 2-2b.

164. **HYDROLYCUS** Müller & Troschel.

842. *H. scomberoides* (Cuvier). Orinoco; Guiana; Rio Capin; Araguay; Iquitos. G., v, 358.  
843. *H. pectoralis* Günther. Marañon; Xeberos. '66b, 30.  
844. *H. copei* Gill. Napo and Marañon. '70, 93.

165. **CYNODON** Spix.

*Raphiodon* Agassiz; *Hydropardus* Reinhardt.

845. *C. vupinus* Spix. Calabozo; Marañon; Huallaga. G., v, 359.  
846. *C. gibbus* Spix. Marañon; Huallaga. G., v, 359.

## CRENUCHINÆ.

166. **CRENUCHUS** Günther.

847. *Ca. spilurus* Günther. Essequibo; Hyavara; Tabatinga. G., v, 365.

## SERRASALMONINÆ.

167. **MYLESINUS** Cuv. & Val.

848. *M. schomburgkii* Cuv. & Val. Guiana; Brazil. G., v, 366.

168. **PYGOPRISTIS** Müller & Troschel.

849. *P. denticulatus* (Cuvier). British Guiana. G., v, 367.  
*Serrasalmo punctatus* Schomb.; *P. fumarius* M. & T.  
850. *P. serrulatus* Cuv. & Val. Araguay; Amazons. G., v, 367.

169. **PYGOCENTRUS** Müller & Troschel.

851. *Py. palometa* Cuv. & Val. Brazil. G., v, 366.  
852. *Py. piraya* (Cuv.). Guiana; Amazons; Rio Puty; Rio das Velhas. G., v, 368.  
*Serrasalmo piranha* Spix; *S. nigricans* Spix.  
853. *Py. scapularis* Günther. Essequibo. G., v, 368.  
854. *Py. niger* (Schomburgk). Upper courses of streams of Guiana. G., v, 369.

855. *Py. nattereri* (Kner). Orinoco: La Plata; Matogrosso and Cujaba. G., v, 369.  
 856. *Py. alatus* Gill. Marañon and Napo. '70, 93.  
 857. *Py. notatus* Lütken. Venezuela. '74, 238.

170. *SERRASALMUS* Lacépède.

858. *S. gibbus* Castelnau. Araguay. G., v, 366.  
 859. *S. caribe* Cuv. & Val. Orinoco. G., v, 366.  
 860. *S. rhombeus* (Linnaeus). Guiana; Araguay. G., v, 369.  
 861. *S. marginatus* Val. La Plata; Brazil. G., v, 370.  
 862. *S. spilopleura* Kner. La Plata; Rio Capin; Brazil; Guiana. G., v, 370.  
     ? *S. aureus* Spix.  
 863. *S. humeralis* Cuv. & Val. Brazil; Huallaga. G., v, 370.  
 864. *S. gymnogenys* Günther. River Capin; British Guiana. G., v, 371.  
 865. *S. maculatus* Kner. Rio Guapore; Huallaga. G., v, 371.  
 866. *S. elongatus* Kner. Rio Guapore; Huallaga. G., v, 371.  
 867. *S. æsopus* Cope. Ambyiacu. '72, 269.  
 868. *S. iridopsis* Cope. Ambyiacu. Cope, '72, 268, Pl. ix, Fig. 2.  
 869. *S. immaculatus* Cope. Marañon. '78, 692.  
 870. *S. brandtii* Reinhardt. Rio das Velhas. Lütken, '75, 237 and Fig.  
 871. *S. iritans* Peters. Apure. '77, 472.

171. *STETHAPRION* Cope.

872. *St. chryseum* Cope. Ambyiacu; Marañon. '72, 261.  
 873. *St. erythrops* Cope. Santarem to Pebas. '70, 562 with Fig.  
 874. *St. copei* Steind. Tabatinga. '82, 40.

172. *MYLETES* Cuvier.

*Myleus* and *Tometes* Cuv. & Val.

875. *M. acanthogaster* Cuv. & Val. Lake Maracaibo. G., v, 372.  
 876. *M. lobatus* Cuv. & Val. Amazon. G., v, 372.  
 877. *M. schomburgkii* Jardine. Amazon; Guiana. G., v, 372 and 376.  
     *M. divaricatus* and *palometa* Cuv. & Val.  
 878. *M. luna* Cuv. & Val. Cayenne. G., v, 372.  
 879. *M. unilobatus* (Cuv. & Val.). Cayenne. G., v, 372.  
 880. *M. edulis* Castelnau. Rio Paraguay. G., v, 372.  
     *M. bidens* Cuv. & Val.  
 881. *M. torquatus* Kner. Rio Branco. G., v, 372.  
 882. *M. asterias* Müller & Troschel. Essequibo, and Mazaruni near Cascades. G., v, 372.  
 883. *M. rubripinnis* M. & T. Essequibo. G., v, 373.  
 884. *M. rhomboidalis* Cuv. Amazon; Guiana. G., v, 373.  
     *Tetragonopterus latus* Schomb.  
 885. *M. parma* Günther. River Capin. G., v, 374.  
 886. *M. macropomus* Cuv. Brazil. G., v, 374.  
 887. *M. brachypomus* Cuv. Brazil; Guiana; La Plata. G., v, 374.  
     *M. facu* Humboldt.  
 . *M. orbignyanus* Cuv. & Val. Parana. G., v, 373.

839. *M. duriventris* Cuv. Calabozo; Buenos Ayres; Santarem to Huallaga. G., v, 375.  
*Tetragonopterus aureus* Spix. -
890. *M. bidens* Spix. Villa Bella to Marañon. G., v, 375.
891. *M. ellipticus* Günther. Essequibo. G., v, 376.
892. *M. hypsauchen* Müller & Troschel. Santarem to Huallaga; Rio Guapore; Tapacuma Lake. G., v, 376.
893. *M. maculatus* Kner. Rios Maroni and Guapore. G., v, 377.
894. *M. altipinnis* (Cuv. & Val.). San Francisco; Cipo. G., v, 377.
895. *M. discoideus* Kner. Brazil. G., v, 377.
896. *M. trilobatus* (Cuv. & Val.). Cayenne. G., v, 378.
897. *M. setiger* (Müller & Troschel). Guiana; Amazon. G., v, 378.  
*M. doidyrodon* Cuv. & Val.; *M. pacu* Schomburgk.
898. *M. oligocanthus* (Müller & Troschel). Demarara. G., v, 378.
899. *M. albiscopis* Cope. Ambyiacu. '72, 267.
900. *M. brachypoma* Günther. La Plata. G., '80.
901. *M. herniarius* Cope. Ambyiacu; Marañon. Cope, '72, 268, Pl. XII, Fig. 3.
902. *M. kneri* Steind. Maroni River, Guiana. '81, 27, Pl. VII, Fig. 2.
903. *M. hippincottianus* Cope. Para. '70, 561.
904. *M. macropomus* Peters. Apure. '77, 473.
905. *M.\* micans* Reinhardt. Rio das Velhas. Lütken, '75, 241 and Fig.
906. *M. nigripinnis* Cope. Teffé; Marañon. Cope, '78, 693.
907. *M. oculus* Cope. Ambyiacu. '72, 268, Pl. XII, Fig. 2.

#### 173. *METYNNIS* Cope.

908. *Me. luna* Cope. Marañon. '78, 692.

#### 174. *CATOPRION* Müller & Troschel.

909. *C. mento* (Cuv.). Guiana; Brazil. G., v, 379.

### GYMNONOTI.

#### XV. *ELECTROPHORIDÆ*.

##### 175. *ELECTROPHORUS* Gill.

910. *E. electricus* Linn. Brazil and northward. G., VIII, 10.

#### XVI. *STERNOPYGIDÆ*.

##### 176. *STERNARCHUS* Bloch & Schneider.

911. *S. albifrons* (Linn.). Brazil and Surinam (Para; Santarem; Manacapuru; Teffé; Obidos; Canelos; Apure; Urubamba; Surinam). G., VIII, 2.  
*Apteronomus prasan* Lac.; *S. lacepedii* and *maximiliani* Castelnau.
912. *S. brasiliensis* Reinhardt. Rio das Velhas. G., VIII, 3.
913. *S. nattereri* Steind. Barra do Rio Negro. G., VIII, 3.
914. *S. schotti* Steind. Barra do Rio Negro; Manacapuru; Peruvian Amazon. G., VIII, 3.



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- 915. *S. bonaparti* Castelnau. Manacapuru; Peruvian Amazon. G., VIII, 3.
- 916. *S. sachsi* Peters. Apure. '77, 473.
- 917. *S. balænopis* Cope. Peruvian Amazon. '78, 682.
- 918. *S. virescens* Val. La Plata. 47a, 11.
- 919. *S. macrolepis* Steind. Amazon near Rio Negro; Manacapuru. '81b, 14.

### 177. STERNARCHORHYNCHUS Castelnau.

- 920. *S. oxyrhynchus* (Müller & Troschel). Essequibo. G., VIII, 4.
- 921. *S. macrostoma* Günther. Upper Amazon. G., VIII, 4.
- 922. *S. mormyrus* (Steind.) Peruvian Amazon. G., VIII, 4.
- 923. *S. curvirostris* Boulenger. Canelos. '78a, 282.
- 924. *S. mülleri* Steind. Para. '81b, 15.

### 178. RHAMPHICHTHYS Müller & Troschel.

- 925. *R. rostratus* (Linnaeus). Guianas; Rio Negro; Matogrosso. G., VIII, 5.  
*Gymnotus longirostris* Lacépède; *R. schomburgkii* and *schneideri* Kaup.
- 926. *R. reinhardti* Kaup. Para; Manacapuru; Rio Negro. G., VIII, 5.  
*R. blochii* Kaup.
- 927. *R. marmoratus* Castelnau. Araguay; Amazons, from Para to Ucayale; Guianas; Orinoco; Rio Plata. G., VIII, 5.  
*R. pantherinus* and *lineatus* Castelnau.

### 179. BRACHYRHAMPHICHTHYS Günther.

- 928. *B. elegans* Steind. Amazon, near Rio Negro. '80, 37,
- 929. *B. artedi* (Kaup). Rio Mona, French Guiana. G., VIII, 6.
- 930. *B. mülleri* (Kaup). French Guiana. G., VIII, 6.
- 931. *B. brevisrostris* Steind. Cauca; Rio Guapore; Santarem. G., VIII, 6.

### 180. STERNOPYGUS Müller & Troschel.

- 932. *S. carapo* (Linnaeus). Rio das Velhas; Amazon, from Para to Canelos, and northward. G., VIII, 7.  
*S. macrurus* Bloch & Schneider; *C. arenatus* Eyd. & Soul.; *C. sanguinolentus* Castelnau; *S. marcgravii* Reinhardt.
- 933. *S. virescens* (Val.). Rio das Velhas; Rio Parana; La Plata; Marañon and tributaries; Guianas; Orinoco. G., VIII, 7.  
*S. tumifrons* and *lineatus* M. & T.; *S. microstomus* Reinhardt.
- 934. *S. axillaris* G. Para. G., VIII, 8.
- 935. *S. troschelli* Kaup. Marañon; British Guiana. G., VIII, 8.  
*S. virescens* Müller & Troschel, not Val.
- 936. *S. æquilabius* Humboldt. Rio Magdalena system; Rivers near Guayaquil (near Corapo). Steind., '78, 54.
- 937. *S. humboldti* Steind. Rio Magdalena system; Mamoni. '78, 55.
- 938. *S. obtusirostris* Steind. Rio Madeira; Lago Alexo; Manacapuru; Tefé; Rio Puty. '81, 43

### 181. CARAPUS Cuv.

- 939. *C. fasciatus* (Pallas). La Plata, north to Guatemala. G., VIII, 9.  
*Gymnotus albus* Pallas, *brachyurus* Bloch; *putaol* Lacépède; *carapo* Bloch & Schneider; *C. brachyurus* Cuvier; *inæquilabius* Valenciennes.

## ISOSPONDYLI.

## XVII. STOLEPHORIDÆ.

## 182. STOLEPHORUS\* Lacépède.

*Ingraulis* Cuvier.

940. *S. macrolepidotus* (Kner & Steind.). Rio Bayano. G., VII, 385.  
941. *S. olidus* Günther. La Plata. '80.  
942. *S. nattereri* (Steind.). Para. '79b, 57.  
943. *S. brevirostris* (Günther). Province of Bahia. G., VII, 392.  
944. *S. poeyi* (Kner & Steind.). Rio Bayano. G., VII, 392.  
945. *S. surinamensis* (Bleeker). Surinam; River Capin; Bahia. G., VII, 393.  
946. *S. spinifer* (Cuv. & Val.). Guianas; Bahia; Panama. G., VII, 394.

## 183. PTERENGRAULIS Günther.

947. *P. atherinoides* (Linnaeus). Guianas; Rio Capin; Para to Gurupa; Rio Janeiro. G., VII, 398.

## 184. LYCENGRAULIS Günther.

948. *L. batesii* G. Rio Para. G., VII, 399.

## XVIII. CLUPEIDÆ.

## 185. CLUPEA Linnaeus.

949. *C. amazonica* Steind. Para. '76, 65.

## 186. PELLONA Cuvier.

950. *P. flavipinnis* Val. Amazon; La Plata. G., VII, 454.  
*P. orbignyana* and *castelnaeana* Cuv. & Val.  
951. *P. altamazonica* Cope. Ambyiaçu. '72, 256.

## XIX. ELOPIDÆ.

## 187. MEGALOPS Lacépède.

052. *M. thrissoides* (Bloch & Schneider). Magdalena system (Atlantic entering rivers). G., VII, 472.  
*Clupea apalike* Lacépède; *gigantea* Shaw; *M. atlanticus* Cuv. & Val.

## XX. OSTEOGLOSSIDÆ.

## 188. OSTEOGLOSSUM Vandelli.

*Ischnosoma* Spix; *Scleropages* Günther.

953. *O. bicirrhosum* Agassiz. Amazons (Para to Huallaga); Guianas. G., VII, 378.  
*O. vandellii* Cuv.; *arowana* Schomburgk; *minus* Val.

\* Many other species of this genus not enumerated here are found on the coasts of South America, and may at times be found in the rivers.

## XXI. ARAPAIMIDÆ.

### 189. ARAPAIMA Müller.

*Sudis* Cuv.; *Vastres* Cuv. & Val.

954. *A. gigas* Cuv. Bahia; Peruvian Amazon; British Guiana. G., vii, 379.  
*S. pirarucu* Spix; *V. cuvieri*, *mapæ*, *agassizii*, *arapaima* Cuv. & Val.

## XXII. GALAXIIDÆ.

### 190. GALAXIAS Cuv.

*Mesites* Jenyns.

955. *G. attenuatus* (Jenyns). Falkland Islands; southern part of South America  
 (? north to Peru). G., vi, 210.  
*G. truttaceus* Val.; *G. scribe* and *maculatus* Richardson.  
 956. *G. coppingeri* Günther. Alert Bay. G., '81, 21.  
 957. *G. maculatus* (Jenyns). Tierra del Fuego; Patagonia. G., vi, 212.  
 958. *G. alpinus* (Jenyns). Alpine fresh-water lakes in Hardy Peninsula, Tierra del  
 Fuego. G., vi, 212.  
 959. *G. gracillimus* (Canestrini). Chili. G., vi, 213.

## XXIII. APLOCHITONIDÆ.

### 191. APLOCHITON Jenyns.

*Farionella* Cuv. & Val.; *Haplochiton* G.

960. *A. zebra* Jenyns. Tierra del Fuego; Falkland Islands (East Bay; fresh water  
 at Tom Bay). G., v, 381.  
*Farionella gayii* Cuv. & Val.  
 961. *A. tæniatus* Jenyns. Tierra del Fuego. G., v, 382.

## HAPLOMI.

## XXIV. CYPRINODONTIDÆ.

### 192. FUNDULUS Lacépède.

962. *F. guatemalensis* Günther. Western Ecuador (Guatemala). G., vi, 321.

### 193. RIVULUS Poey.

963. *R. urophthalmus* Günther. Para. G., vi, 327.  
 964. *R. micropus* (Steind.) Rio Negro to Pebas; Venezuela; Trinidad.  
 Not *R. micropus* Günther, vi, 327 = nom. sp. nov.  
 965. *R. ocellatus* Hensel. Rio de Janeiro. '68, 365.  
 966. *R. elegans* Steind. Cauca. '80, 33.  
 967. *R. poeyi* Steind. Cayenne; Para. '76, 117.

### 194. CYNOLEBIAS Steind.

968. *C. elongatus* Steind. La Plata. '81a, 11.  
 969. *C. bellottii* Steind. La Plata. '81a, 9.

970. *C. maculatus* Steind. La Plata. '81a, 10.  
971. *C. robustus* Günther. San Antonio; Buenos Ayres. '83.  
972. *C. porosus* Steind. Pernambuco. '76, 124.

195. **ORESTIAS** Cuv.

973. *O. cuvieri* Cuv. & Val. Lake Titicaca. G., vi, 328.  
*O. humboldtii* Cuv. & Val.  
974. *O. pentlandii* Cuv. & Val. Lake Titicaca. G., vi, 329.  
975. *O. jussiei* Cuv. & Val. Lake Titicaca. G., vi, 329.  
976. *O. agassizii* Cuv. & Val. Lakes Titicaca and Junin. G., vi, 330.  
*O. oweni* Cuv. & Val.; *O. techuui* Castelnau.

196. **JENYNSIA** Günther.

977. *J. lineata* (Jenyns). Maldonado. G., vi, 331.

197. **ANABLEPS** Bloch.

978. *A. anableps* (Linnaeus). Guianas. G., vi, 337.  
*A. tetrophthalmus* Bloch; *surinamensis* Lacépède; *gronorii* Cuv. & Val.; *lineatus* Gronow.  
979. *A. elongatus* Cuv. & Val. Cayenne. Cuv. & Val., xviii, 267, Pl. 541.

198. **POECILIA** Bloch & Schneider.

980. *P. gilhi* (Kner & Steind.). Rio Chagres. '64, Pl. 4, Fig. 1.  
981. *P. surinamensis* Müller & Troschel. Surinam. '44, 36.  
982. *P. vivipara* Bloch & Schneider. Brazil; Guianas; Martinique. G., vi, 345.  
*P. surinamensis* Val.; *schneideri* Cuv. & Val.  
983. *P. unimaculata* Val. Rio de Janeiro; Parahyba; Surinam; Cayenne. G., vi, 347.  
984. *P. punctata* Cuv. & Val. Montevideo. G., vi, 347.

199. **GIRARDINUS** Poey.

985. *G. reticulatus* (Peters). Caracas; Brazil. G., vi, 352.  
986. *G. guppi* Günther. Trinidad; Venezuela. G., vi, 353.  
987. *G. decemmaculatus* (Jenyns). Maldonado; Rio dos Sinos near S. Leopoldo. G., vi, 354.  
988. *G. januarius* Hensel. Rio de Janeiro. '70, 360.  
989. *G. caucanus* Steind. Cana. '80.  
990. *G. caudimaculatus* Hensel. Costa do Serra. '68, 362.  
991. *G. iheringii* Boulenger. Rio Grande do Sul. '89.

## SYNENTOGNATHI.

XXV. **BELONIDÆ**.200. **TYLOSURUS** Cocco.

992. *T. microps* Günther. Guianas. G., vi, 237.  
993. *T. amazonicus* (Steind.). Para; Manacapuru; Tajapuru. '75c, 66.  
994. *T. almeida* (Quoy & Gaimard). Demarara; Surinam. G., vi, 244.  
*Belone timucu* Cuv. & Val.; *B. tr. guianensis* Günther.  
Proc. N. M. 91 — 5

995. *T. hians* (Cuv. & Val.). Bahia (chiefly salt-water species, West Indies, Panama). G., VI, 248.  
*B. maculata* Poey.

201. **POTAMORRHAPHIS** Günther.

996. *P. guianensis* (Schomburgk). Rio Mana; Rio Capin; Amazons. G., VI.  
*Belone scolopacina* Cuv. & Val.; *B. taniata* Günther.

PERCESOCES.

XXVI. MUGILIDÆ.

202. **MUGIL** Linnæus.

997. *M. platanus* Günther. Rio Plata. G., '80, 9.

203. **PROTISTIUS** Cope. (Mugilidæ ?)

998. *P. semotilus* Cope. Peruvian Andes. '74, 66. (Altitude, 12,000 feet.)

204. **GASTROPTERUS** Cope. (Mugilidæ ?)

999. *G. archæus* Cope. Arequipa, Pacific slope of Peru. '78, 700. (Altitude, 7,500 feet.)

XXVII. ATHERINIDÆ.

205. **CHIROSTOMA** Swainson.\*

*Atherinoides*; *Atherinichthys* Bleeker; *Heterognathus* Girard.

1000. *C. microlepidota* (Jenyns). Rio Mapocho, Chili. G., III, 403.  
 1001. *C. bonariensis* (Cuv. & Val.). Rio Plata. G., III, 404.  
 1002. *C. argentinensis* (Cuv. & Val.). Rio Plata. G., III, 405.

PERCOMORPHI.

XXVIII. POLYCENTRIDÆ.

206. **POLYCENTRUS** Müller & Troschel.

1003. *P. schomburgkii* Müller & Troschel. Essequibo. G., III, 370.  
 1004. *P. tricolor* Gill. Trinidad. G., III, 371.

207. **MONOCIRRHUS** Heckel.

1005. *M. polyacanthus* Heckel. Rio Cupai; Ponds near the Rio Negro.

XXIX. SERRANIDÆ.

208. **PERCICHTHYS** Girard.

1006. *P. lævis* (Jenyns). Santa Cruz River, Patagonia. G., I, 61.  
 1007. *P. trucha* (Cuv. & Val.). Rio Negro, Patagonia; fresh waters of Chili. G., I, 61.

\* It is quite certain that some of these species do not belong to the genus *Chirostoma*, and probably none of them do.

1008. *P. chilensis* Girard. Rio de Maypu, near Santiago, Chili. '55, 231, Pl. 29, Figs. 1-4.  
1009. *P. melanops* Girard. Rio de Maypu. G., 1, 61.

209. **PERCILIA** Girard.

1010. *P. gillissii* Girard. Rio de Maypu. G., 1.

XXX. **SPARIDÆ.**

210. **PRISTIPOMA** Cuvier.

1011. *P. humile* Kuer & Steind. Mamoni; Bayano. '64, 1, Pl. 1, Fig. 1.

XXXI. **SCIÆNIDÆ.**

211. **PLAGIOSCION** Gill.

*Diplolepis* Steind.

1012. *P. squamosissimus* (Heckel). Brazil and northward. G., II, 526.  
*S. rubella* Schomburgk; *J. crouvina* and *amazonicus* Castelnau.  
1013. *P. surinamensis* (Bleeker). Magdalena system; Surinam. J. & E., '89, 40.  
*S. magdalene* Steind.  
1014. *P. auratus* (Castelnau). Rivers of Brazil. G., II, 287.

212. **PACHYURUS** Agassiz.

*Lepipterus* Cuv. & Val.

1015. *P. squamipinnis* Agassiz. Rio San Francisco and tributaries. G., II, 281.  
*P. lundii* Reinhardt.  
1016. *P. francisci* (Cuv. & Val.). Rio San Francisco and tributaries. G., II, 281.  
*P. corvina* Reinhardt.  
1017. *P. bonariensis* Steind. Rio de la Plata. J. & E., '89, 70.  
1018. *P. schomburgkii* Günther. Amazon and tributaries. G., II, 282.

213. **PACHYPOPS** Gill.

1019. *P. furcæus* (Lacépède). Amazon and tributaries; Surinam. J. & E., '89, 71.  
*C. biloba* Cuv. & Val.  
1020. *P. trifilis* (Müller & Troschel). Guiana; Rio Negro; Rio Guapore. G., II, 273.  
1021. *P. adspersus* (Steind.). Southeastern Brazil.\*

XXXII. **CICHLIDÆ.**†

214. **ASTRONOTUS** Swainson.

*Acara* Heckel; *Cychlasoma* Gill; *Acaropsis* Steindachner; *Hygrogonus* Günther; *Heros* Heckel; *Herichthys* Baird & Girard; *Hoptarchus* Kaup; *Theraps* Günther; *Mesonauta* Günther; *Uaru* Heckel; *Petenia* Günther.

\* Several other species are found in the mouth of the Rio Plata. For an account of all the South American Sciænidae see Jordan & Eigenmann, "A Review of the Sciænidae of America and Europe," Annual Report Commissioner Fish and Fisheries, 1896. J. & E., '89.

† This family has been ably reviewed by Steindachner. Beiträge zur Kenntniss der Chromiden des Amazonenstromes. Sb. Ak. Wiss., Wien, LXXI, 1875. '75d.

§ *Astronotus*.

1022. *A. ocellata* (Agassiz). Brazil; Paraguay; Amazons; Guiana. G., IV, 303.  
*A. crassispinis* Heckel; *C. rubro-ocellata* Schomburgk; *A. compressus* Cope.

§ *Acaropsis* Steindachner.

1023. *A. nassa* Heckel. Amazons; Guiana. G., IV, 281.  
*A. cognatus*, *unicolor* Heckel; ? *Centrarchus cyanopterus* Schomb.

§ *Acara* Heckel.\*

1024. ? *A. filamentosus* (Lacépède). ? G., IV, 276.  
 1025. ? *A. planifrons* (Knp). ? G., IV, 276.  
 1026. *A. tetramerus* Heckel. Rio Puty; Amazons; Guiana; ditches near Mato-grosso. G., IV, 277.  
*A. viridis*, *diadema*, *pallida*, and *dimerus* Heckel; ? *flavilabris* Cope; *uniocellata* Castelnau.  
 1027. *A. gymnopoma* Günther. ? G., IV, 278.  
 1028. *A. vittata* Heckel. Paraguay; Amazons. G., IV, 278.  
 1029. *A. pulchra* (Gill). Trinidad; Western Ecuador. G., IV, 280.  
*C. rivulata* Günther.  
 1030. *A. dorsigeia* Heckel. Paraguay; Amazons. G., IV, 280.  
 1031. *A. obscura* (Castelnau). Paraguassu, Province Bahia. G., IV, 281.  
 1032. *A. unipunctata* (Castelnau). Tocantins; Paraguassu; Province Bahia. G., IV, 283.  
 1033. *A. cœruleopunctata* Kner & Steind. Rio Chagres and western slope of Andes. '64, 16, Pl. II, Fig. 3.  
 1033a. *A. c. latifrons* Steind. Magdalena system. '78, 11.  
 1034. *A. punctulata* Günther. Essequibo. '63a.  
 1035. *A. subocularis* Cope. Marañon. Cope, '78, 696.  
 1036. *A. hypsosticta* Cope. Marañon. Cope, '78, 697.  
 1037. *A. sypsilus* Cope. Marañon; Canelos. '72, 255, Pl. XI, Fig. 3.  
 1038. *A. maronii* Steind. Maroni River, Guiana. '81, 41.  
 1039. *A. thayeri* Steind. Lago Maximo; Hyuanuary. '81, 8.  
 1040. *A. portalegrensis* Hensel. Porto Alegre. '70, 53.  
 1041. *A. minuta* Hensel. Porto Alegre. '70, 53.  
 1042. *A. freniferus* Cope. Ambyiacu. '78, 255.

§ *Heros* Heckel.

1043. *A. bimaculata* (Linnaeus). Ceara to Trinidad; Huallaga and Guapore. G., IV, 276.  
*Labrus brunneus* Gronow; *L. punctatus* Bloch; *Chromis taenia* Benn.; *Acara gronovii*, *margarita*, and *marginata* Heckel.  
 1044. *A. facetus* (Jenyns). Maldonado; Rio Plata. G., IV, 290.  
 1045. *A. psittacus* (Heckel). Rio Negro. G., IV, 290.  
*Hoplarchus pentacanthus* Kaup.  
*A. severus* Heckel. ? Parahyba; Amazons; Guisua. G., IV, 293.  
*H. corypterus*, *modestus* and *spurius* Heckel; *Chromys appendiculata* and *fasciata* Castelnau; *Urus centrarchoides* Cope.

\**A. adspersa* Günther. Barbados. G., IV, 282. *A. fusco-maculatus* (Guichenot). Cuba. G., IV, 282. *C. tetracanthus* Cuv. & Val.

1046. *A. efasciatus* (Heckel). Rio Negro. G., iv, 294.  
1047. *A. coryphaenoides* (Heckel). Rio Negro; Obidos; Jatuarana; Lake Saraca. G., iv, 296.  
1048. *A. oblongus* (Castelnau). Tocantins, Province Goyaz. G., iv, 299.  
1049. *A. autochthon* (Günther). Marañon; southeastern Brazil.  
1050. *A. crassa* (Steind.). Amazons. '75d, 88.  
1051. *A. imperialis* (Steind.). Amazon, near Rio Negro. '79b, 43.  
1052. *A. acaroides* (Hensel). Porto Alegre. '70, 54.

§ *Mesonauta* Günther.

1053. *A. festivus* (Heckel). Amazons. G., iv, 300.  
*H. insignis* Heckel; *Chromys acora* Castelnau.

§ *Uaru* Heckel.

1054. *A. amphacanthoides* Heckel. Amazons. G., iv, 302.  
*U. obscurum* Günther; *Pomotis fasciatus* Schomb.

§ *Petenia*.

1055. *A. kraussi* Steind. Magdalena system. '78, 12.  
1056. *A. spectabilis* Steind. Gurupa; Obidos. '75d, 36.

215. **CRENICARA** Steind.

1057. *C. elegans* Steind. Gurupa; Cudajas; Curupira. '75d, 99.

216. **DICROSSUS** Agassiz.

1058. *D. maculatus* Steind. Amazons. '75d, 42.

217. **CICHLA** Bloch & Schneider.

1059. *C. ocellaris* Bloch & Schneider. Amazons; Guiana. G., iv, 304.  
*C. monoculus* Agassiz; *C. atabapensis* Humboldt; ? *C. toucoumarai* Castelnau.  
1060. *C. temensis* Humboldt. Amazons. G., iv, 304.  
*C. tucunare* Heckel.  
1061. *C. multifasciata* Castelnau. Ucayale. G., iv, 305.  
1062. *C. conibus* Castelnau. Ucayale. G., iv, 305.

218. **CRENICICHLA** Heckel.

*Batrachops* Heckel.

1063. *Cr. obtusirostris* Günther. Rio Capin. G., iv, 306.  
1064. *Cr. brasiliensis* Bloch & Schneider. Amazons; Guiana. G., iv, 306.  
1064a. *Cr. brasiliensis vittata* Heckel. G., iv, 306.  
1064b. *Cr. brasiliensis strigata* Günther. Rios Capin and Cupai. G., iv, 306.  
1064c. *Cr. brasiliensis lenticulata* Heckel. Rio Negro. G., iv, 306.  
1064d. *Cr. brasiliensis adspersa* Heckel. Rio Guapore. G., iv, 307.  
1064e. *Cr. brasiliensis lugubris* Heckel. Rio Negro. G., iv, 307.  
1064f. *Cr. brasiliensis funebris* Heckel. Rio Capin; Guiana. G., iv, 306.  
1064g. *Cr. brasiliensis johanna* Heckel. Rio Cupai. G., iv, 307.  
1065. *Cr. acutirostris* Günther. Rio Cupai. G., iv, 307.



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1066. *Cr. macrophthalma* Heckel. Rios Negro and Orinoco. G., IV, 307.  
 1067. *Cr. proteus* Cope. Marañon. '72, 252.  
 1067a. *Cr. proteus argynnis* Cope. Marañon. '72, 253.  
 1068. *Cr. saxatilis* (Linnaeus). Amazons; Guiana. G., IV, 308.  
*C. labrina* Agassiz; *Scarus paronius* Gronow.  
 1069. *Cr. lepidota* Heckel. Porto Alegre; Rio Cadea. Steind., '74, 23.  
 1070. *Cr. frenata* Gill. Trinidad. '58.  
 1071. *Cr. lacustris* (Castelnau). Southeastern Brazil. G., IV, 308.  
 1072. *Cr. orinocensis* (Humboldt). Rios Negro and Orinoco. G., IV, 309.  
*C. argus* Valenciennes.  
 1073. *Cr. reticulata* (Heckel). Rio Negro. G., IV, 309.  
 1074. *Cr. semifasciata* (Heckel). Rio Paraguay, province of Matagrosso. G., IV, 309.  
 1075. *Cr. punctata* Hensel. Santa Cruz, Rio Grande do Sul. '70, 57.  
 1076. *Cr. polysticta* Hensel. Rio Cadea, Rio Grande do Sul. Hensel, *loc. cit.*, '70, 58.  
 1077. *Cr. proteus* Cope. Marañon. '72, 252.  
 1078. *Cr. anthurus* Cope. Marañon. '72, 252.  
 1079. *Cr. lucius* Cope. Marañon. '70, 570.  
 1080. *Cr. cyanonotus* Cope. Marañon. '70, 569.  
 1081. *Cr. elegans* Steind. Marañon. '81a, 15.

219. *CHÆTOBRANCHUS* Heckel.

1082. *Ch. flavescens* Heckel. Amazons; Rio Negro; Rio Guapore. G., IV, 310.  
*Ch. brunneus* Heckel; *Ch. robustus* Günther; ? *Chromys ucayalensis* Castelnau;  
 ? *Geophagus badiipinnis* Cope.  
 1083. *Ch. semifasciatus* Steind. Amazons. '75d, 70.

220. *CHÆTOBRANCHOPSIS* Steind.

1084. *C. orbicularis* Steind. Amazon. '75d, 133.

221. *SARACA* Steind.

1085. *S. opercularis* Steind. Villa Bella; Lake Saraca. Steind., '75d, 65.

222. *GEOPHAGUS* Heckel.

§ *Mesops* Günther.

1086. *G. thayeri* Steind. Amazons. Steind., '75d, 48.  
 1087. *G. cupido* Heckel. Amazons. G., IV, 311.  
 1088. *G. tæniatus* (Günther). Amazons. G., IV, 312.  
*M. amarus* Cope.  
 1089. *G. agassizii* Steind. Rio Puty; Amazons. '75d, 51.  
 1090. *G. badiipinnis* Cope. Marañon. '72, 251.

§ *Satanoperca* Günther.

1091. *G. acuticeps* Heckel. Amazons. G., IV, 312.  
 1092. *G. lapidifera* (Castelnau). Araguay near Grand Cascade. G., IV, 236.  
 1093. *G. pappaterra* Heckel. Rio Guapore. G., IV, 313.  
 1094. *G. daemon* Heckel. Amazons. G., IV, 313.

1095. *G. jurupari* Heckel. Amazons. G., IV, 313.  
*G. leucostictus* M. & T.; *S. macrolepis* Günther.
1096. *G. crassilabris* Steind. Panamá. '76, 17.  
*Geophagus* Heckel.
1097. *G. brasiliensis* Quoy & Gaimard. Coast rivers from La Plata to Bahia;  
Canca. G., IV, 278, as *Acara brasiliensis*.
1098. *G. surinamensis* (Bloch). Amazons; Guiana. G., IV, 315.  
*G. megasema* and *altifrons* Heckel; *Chromis proxima* ♂ Castelnau.
1099. *G. rhabdotus* Hensel. Rio Cadea. '70, 60.
1100. *G. gymnogenys* Hensel. Mountain streams of Rio Grande do Sul. Hensel,  
'70, 61.
1101. *G. bucephalus* Hensel. Rio Cadea. Hensel, '70, 63.
1102. *G. labiatus* Hensel. Rio Santa Maria, in province of Rio Grande do Sul. '70,  
64.
1103. *G. scymnophilus* Hensel. Mountain streams of Rio Grande do Sul. Hensel,  
'70, 65.
1104. *G. pygmaeus* Hensel. Guahyba, near Porto Alegre. Hensel, '70, 68.

#### 223. SYMPHYSODON Heckel.

1105. *S. discus* Heckel. Amazons. G., IV, 315.

#### 224. PTEROPHYLLUM Heckel.

*Platazoides* Castelnau.

1106. *P. scalare* (Cuv. & Val.). Amazons. G., IV, 316.  
*Platazoides dumerilii* Castelnau.

### XXXIII. GOBIIDÆ.\*

#### 225. GOBIOMORUS Lacépède.

*Philypnus* Cuv. & Val.; *Lembus* Günther.

1107. *G. dormitor* Lacépède. Surinam. G., III, 119.  
*B. guavina* Bl. & Schn.
1108. *G. maculatus* (Günther). Streams of Ecuador; Mamoni River. G., I, 505.

#### 226. DORMITATOR Gill.

1109. *D. grandisquama* (Cuv. & Val.). America. G., III, 113.

#### 227. GUAVINA Bleeker.

1110. *G. guavina* (Cuv. & Val.). Goyaz, Rio Grande do Sul. G., III, 124.
1111. *G. brasiliensis* (Sauvage). Bahia. '80, 53.

#### 228. ELEOTRIS Gronow.

*Culius* Bleeker.

1112. *E. amblyopsis* Cope. Surinam. Eigenm. & Eigenm. '88, 55.
1113. *E. pisonis* (Gmelin). Ascends rivers from the Amazon to Rio Janeiro; Rio  
Bayano. G., III, 122.  
*G. amorea* Walbaum; *E. gyrinus* Cuv. & Val.; *E. pictus* Kner & Steind.

\* The South American species of this family have been discussed by us in Proceedings California Academy of Sciences, 2d ser., vol. I, pp. 51-76, 1888.

1114. *E. perniger* Cope. Rio Janeiro (St. Martins). '70, 473.

229. **SICYOPTERUS** Gill.

*Cotylopus* Guichenot; *Sicydiops* Bleeker.

1115. *S. salvini* Grant. Pacific slope of Panama. '84, 159.

230. **GوبيUS** Linnaeus.

1116. *G. soporator* Cuv. & Val. Occasionally entering rivers (Rio Doce). Abundant in all tropical American seas G., III, 26.

*G. catulus* Girard; *G. mapo* and *lacertus* Poey; *G. carolinensis* Gill.

1117. *G. badius* (Gill). Amazon. Eigenm. & Eigenm. '88, 65.

*G. bosci* Sauvage.

231. **RHINOGOBIUS** Gill.

1118. *R. flavus* (Cuv. & Val.). Surinam; Rio Doce. Eigenm. & Eigenm. '88, 67.

1119. *R. taiaiaica* (Lichtenstein). Rio Doce (chiefly tropical seas of America).

*G. banana* Cuv. & Val.; *E. latus* O'Shaughnessy.

232. **GوبيOIDES** Lacépède.

1120. *G. broussoneti* Lacépède. Rivers near the coast, south to Rio Janeiro. Jordan & Eigenm. '86, 512.

*G. brasiliensis* Cuv. & Val.; *G. oblongus* Bl. & Schn.; *G. barreto* Poey.

1121. *G. peruanus* (Steind.). Guayaquil. Eigenm. & Eigenm. '88, 75.

XXXIV. **BATRACHIDÆ.**

233. **THALASSOPHRYNE** Günther.

1122. *T. amazonica* Steind. Mouth of Rio Negro; Tabatinga; Xingu. '76, 113.

1123. *T. nattereri* Steind. Para. '76, 115.

234. **BATRACHOIDES** Lacépède.

1124. *B. pacifici* (Günther). Mamoni River. G., III, 173.

**HETEROSOMATA.**

XXXV. **PLEURONECTIDÆ.\***

235. **CITHARICHTHYS** Bleeker.

*Orthopsetta* Gill; *Metoponops* Gill.

1125. *C. spilopterus* Günther. Entering rivers; Para; Rio das Velhas. G., IV, 421.

*C. cayennensis* and *guatamalensis* Bleeker; *Hemirhombus fuscus* Poey.

236. **ACHIRUS** Lacépède.

*Trinectes* Rafinesque; *Grammichthys*, *Monochirus* Kaup; *Bæostoma* Bean.

1126. *A. klunzingeri* (Steind.) Guayaquil. '80, 44.

\* For a full account of all the American species see Jordan and Goss: A Review of the Flounders and Soles. Rept. Comm. Fish and Fisheries, 1886.

1127. *A. lineatus* (Linnæus). All streams, Cayenne to Rio Grande do Sul; Amazonas to Tabatinga. G., IV, 473.  
*Monochir maculipinnis* Agassiz.
1128. *A. fischeri* (Steind.). Mamoni. '79, 13.
1129. *A. garmani* Jordan. Rio Grande do Sul. J. & G., '89, 314.
1130. *A. jenynsii* (Günther). Rio de la Plata. G., IV, 476.  
*A. lorentzi* Weyenbergh.

### 237. *ACHIOPSIS* Steind.

1131. *A. nattereri* Steind. Rio Negro. '76, 110.
1132. *A. asphyxiatus* Jordan. Goyaz. J. & G., '89, 318.

### 238. *APIONICHTHYS* Kaup.

*Soleotalpa* Günther.

1133. *Ap. unicolor* (Günther). Surinam; Amazon, near Obidos. G., IV, 489.  
*A. dumerili* Bleeker; *A. nebulosus* Peters.

### 239. *SYMPHURUS* Rafinesque.

*Bibronia Cocco*; *Plagusia* Cuvier; *Aphoristia* Kaup; *Glossichthys* Gill; *Amopლეუrops* Günther; *Acedia* Jordan.

1134. *S. plagusia* Bloch & Schneider. Rio Plata (east coast of South America; West Indies). G., IV, 490.  
*Achirus ornatus* Lacépède; *Plagusia tessellata* Quoy & Gaimard; *brasiliensis* Agassiz.

## PLECTOGNATHI.

### XXXVI. TETRAODONTIDÆ.\*

#### 240. *COLOMESUS* Gill.

*Batrachops* Hollard.

1135. *C. psittacus* (Bloch & Schneider). Rio Capin; Marañon; Guiana. G., VIII, 286.  
*Cheilichthys asellus* M. & T.

The following species we have not been able to give a place in this catalogue :

- Centrarchus cyanoperca* Schomburgk. Essequibo. Fish British Guiana, II, 165, Pl. XVI, 1843.
- C. cycula* Sch. Rio Negro. *Loc. cit.*, 157, Pl. XI.
- C. niger* Sch. Rio Negro. *Loc. cit.*, 159, Pl. XII.
- C. notatus* Sch. ? *Loc. cit.*, 160, Pl. XIII.
- C. rostratus* Sch. Rio Negro. *Loc. cit.*, 163, Pl. XV.
- C. vittatus* Sch. ? *Loc. cit.*, 161, Pl. XIV.
- Chalceus labrosus* Sch. Paduiri. *Loc. cit.*, I, 212, Pl. XIII, Fig. 1.
- C. latus* Sch. Paduiri. *Loc. cit.*, 214.
- C. taniatus* Sch. Essequibo; Rio Negro. *Loc. cit.*, I, 210.
- Chromys ocellata* Castelnau. Amazon; Ucayale. '55, 16.

\* Other species of this family will probably be found in the lower courses of many rivers. For an account of the American species see Jordan and Edwards, Proc. U. S. Nat. Mus., 1886, pp. 230-247.

- Cychna fasciata* Sch. *Loc. cit.*, II, 141, Pl. IV.  
*C. flavo-maculata* Sch. Rio Negro; Paduiri. *Loc. cit.*, 145, Pl. VI.  
*C. rutilans* Sch. Rio Branco. *Loc. cit.*, II, 142, Pl. V.  
*C. nigro-maculata* Sch. Rio Negro; Paduiri. *Loc. cit.*, 147, Pl. VII.  
*C. trifasciata* Sch. Rio Negro; Paduiri. *Loc. cit.*, 151, Pl. IX.  
*C. toucounarai* Castelnau. Lac de Perles (Goyaz); Tocantins; Amazon. '55, 17, Pl. x, Fig. I.  
*Pomotis bono* Sch. All rivers of Guiana. *Loc. cit.*, 171, Pl. XVIII.  
*Leporinus brachyurus* Cuv. & Val. XXII, 36.  
*Salmo emarginatus* Sch. *Loc. cit.*, I, 231, Pl. XIX.  
*Salmo undulatus* Sch. Paduiri. *Loc. cit.*, I, 232.  
*Serrasalmo scotopterus* Sch. Rio Branco. *Loc. cit.*, II, 233.  
*S. stagnalis* Sch. Upper Essequibo. *Loc. cit.*, I, 222.

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Proc. N. M. 91—6



FISHES COLLECTED BY WILLIAM P. SEAL IN CHESAPEAKE BAY,  
AT CAPE CHARLES CITY, VIRGINIA, SEPTEMBER 16 TO OCTOBER  
3, 1890.

BY

BARTON A. BEAN,

*Assistant Curator of the Department of Fishes.*

On the 15th of September, 1890, Mr. William P. Seal, of the U. S. Fish Commission, left Washington and proceeded to Cape Charles City, Virginia, on Chesapeake Bay, about 5 miles north of Cape Charles, for the purpose of collecting living fishes for the national aquaria at Washington, District of Columbia. He was accompanied by Messrs. L. G. Harron and D. W. Kenly, also of the Fish Commission, and by the writer in behalf of the U. S. National Museum. Mr. Seal carried with him the necessary outfit for collecting purposes. It consisted of nets and seines, tubs, buckets, transportation boxes and cans for live fishes, live boxes, and an outfit of tents, etc., for the accommodation of his party, which camped upon the beach immediately in front of the town of Cape Charles. The party, with the exception of the writer, remained there until October 4, when they returned to Washington. As a result of this trip a very creditable exhibit of living fishes was obtained and quite a little added to our knowledge of the marine life in the Chesapeake.

We found the water quite shallow in front of the town and the first few hauls of a 30-fathom seine brought up quite a number of species. King's Creek, which is about  $1\frac{1}{2}$  miles north of the town, is one of the richest collecting grounds in the neighborhood. It is a good feeding place for fishes. The pound nets furnish much of interest to the collector. Sterling Bros., of Cape Charles City, are always very obliging and of much assistance to those seeking specimens and information concerning the fisheries. Cape Charles City is the shipping point for all the fishes taken in pound nets for a distance of 10 miles. It is the terminus of the New York, Philadelphia and Norfolk Railroad, and is connected with Norfolk by steamers twice daily.

Besides the species listed by me, Mr. Seal observed the following: *Chilomycterus*, *Astrosopus*, *Stromateus triacanthus*, *Sphyræna*, and *Sphyrna zygaena*. When it is not specifically stated the common names given do not refer to Cape Charles. The water of this portion of the bay is very salt, there being no tributary streams of fresh water of any consequence on the eastern shore of Virginia.

I am indebted to the U. S. Fish Commission for the early use of the material collected by Mr. Seal, and to Dr. T. H. Bean and Dr. T. Gill for various suggestions in the preparation of this paper.

1. *Tetrodon turgidus* Mitch. Swell-fish or Puffer.

U. S. N. M. 43153. Individuals from 3 to 10 inches long were common in the bay at Cape Charles City. They were seined and taken in pound nets. At St. Jerome's, Maryland, in September, 1889, Mr. Seal saw a few of this species in boats, but none were seined by his party. This is called sucking toad at Cape Charles, Virginia.

2. *Alutera schœpfi* Walb. File-fish.

U. S. N. M. 43146. Many specimens were taken but they could not be kept alive for the aquaria. It is called fool fish at Cape Charles because, as the fishermen say, it is too foolish to get out of the way of anything. Those observed ranged in length from 6 to 12 inches, occurring in the pounds and seine.

3. *Monacanthus hispidus* L. Short File-fish.

U. S. N. M. 43177, 43204. A large number of examples were seined in the bay at Cape Charles City, where it is called fool fish. The individuals observed measured from  $2\frac{1}{2}$  to 7 inches in length.

4. *Siphostoma fuscum* Storer. Pipe Fish.

U. S. N. M. 43212. Sixteen specimens. This species is common in the bay.

5. *Siphostoma louisianæ* Gthr.

U. S. N. M. 43206. This species is rare in the bay, so far as we have observed, and Mr. Seal obtained but two examples. These measured 11 and 12 inches respectively. Mr. Seal secured this fish, also, at St. Jerome's, Maryland, in September, 1889.

6. *Achirus lineatus* L. Sole; Hog Choker.

Abundant throughout the bay and in the Lower Potomac River.

7. *Aphoristia plagiosa* L.

U. S. N. M. 43207, 43226. Five specimens, 2 to 3 inches long, were seined at Cape Charles City.

8. *Citharichthys microstomus* Gill.

U. S. N. M. 43227. Six specimens, measuring from 1 to 3 inches, were collected by the seine.

D. 80-83; A. 63-64; scales 45-47.

9. *Paralichthys dentatus* L. Flounder.

U. S. N. M. 43162. Numerous young of this species were seined and larger ones taken in the pound nets at the time of Mr. Seal's visit. The one here catalogued is but  $4\frac{1}{2}$  inches long. In May, 1889, Mr. Seal obtained the young of the common flounder at Point Lookout, Maryland, securing specimens from 1 to  $1\frac{1}{2}$  inches long, and in September, 1889, he collected examples from 5 to 10 inches in length at St. Jerome's, Maryland.

The flounder is called chicken halibut by the bay fishermen and also by marketmen in Norfolk, Virginia, and Washington, District of Columbia.

10. *Bothus maculatus* Mitch. Sand Flounder.

U. S. N. M. 43131, 43179. Two specimens measuring  $6\frac{1}{2}$  and 9 inches in length. This species was obtained in small numbers by Mr. Seal, and several specimens were brought alive to Washington, where they do well in the marine aquaria.

No. 43131 has D. 62; A. 52; V. 6.

The pectoral of the eyed side is much longer than that of the blind side, and contains one spine and nine rays, while that of the blind side has but eight rays. The length of the eye is one-fourth that of the head, and the mandible is slightly less than half length of head. Eyed side and fins profusely spotted with brown, and the scales are edged with black.

11. *Ophidium marginatum* De Kay.

U. S. N. M. 43168. One specimen,  $4\frac{3}{4}$  inches long.

Mr. Seal seined several examples of this species at Cape Charles City, a few of which were brought alive to Washington.

12. *Hypsoblennius punctatus* Wood. Blenny.

U. S. N. M. 43160, 43215. Eight specimens from 2 to 5 inches long. Abundant on oyster beds.

By the bay fishermen the blennies are confounded with the toadfish, *Batrachus tau*.

D. XII, 14-15; A. 18; P. 14.

13. *Chasmodes bosquianus* Lac. Oyster Blenny.

U. S. N. M. 43218. Two specimens,  $2\frac{1}{4}$  inches long. Common on the oyster beds. Mr. Seal found this species in considerable numbers on the oyster beds of the Lower Potomac in May, 1889. I found a lernean parasite attached to the dorsal membrane of one of the specimens.

This little fish is often found in oyster shells, where it apparently seeks refuge from enemies. In January, 1889, Mr. Evan Lyons, of Georgetown, District of Columbia, bought some oysters in Washington, and upon opening one, which he had kept two or three days, instead



of an oyster he found an oyster blenny. The fish was alive when found, and had eaten the oyster, which, in all probability, had inclosed the blenny a week or so before. Mr. Seal found an empty quahaug shell inhabited by a *Chasmodes*, the eggs of which were attached to the sides of the shell.

14. *Batrachus tau* L. Toadfish.

Called bullfish at Cape Charles City, where it is very common. Individuals from an inch to 1 foot in length were taken.

The toadfish is found in large numbers in the Lower Potomac and at St. Jerome's, Maryland. Mr. Seal says the fishermen eat them and pronounce the flesh excellent, although they are never shipped to market.

15. *Gobiosoma bosci* Lac. Goby.

U. S. N. M. 43220 Four specimens, from 1 to 2 inches long.

In May, 1889, Mr. Seal found this species quite abundant on the oyster beds of the Lower Potomac, and in September, 1889, he secured several specimens at St. Jerome's, Maryland.

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16. *Prionotus strigatus* Mitch. Sea Robin.

U. S. N. M. 43201. One specimen,  $5\frac{1}{2}$  inches long. Several specimens were obtained and brought alive to Washington.

17. *Hiatula onitis* L. Tautog; Black Fish.

U. S. N. M. 43133, 43172. Two specimens, from  $2\frac{1}{2}$  to  $5\frac{1}{2}$  inches long.

In the bay at Cape Charles City the young of this species were seined in large numbers. In May, 1889, Mr. Seal secured two specimens 15 inches long, which had been taken with hook and line off Point Lookout.

18. *Gerres argenteus* Cuv. & Val. Silver Jenny.

U. S. N. M. 43173, 43216, 43221. We seined large numbers of this species in the bay at Cape Charles City. They ranged in length from 1 to 3 inches. None were seen in the pounds by me. The name Silver Jenny was given me by a gentleman at Cape Charles, who said it is applied to this fish and that the species grows much larger than any specimens we had, and also that it is a good food fish. I think the young *Gerres* must be mistaken for the young of *Bairdiella*, which is known as silver perch.

19. *Chaetodipterus faber* Brous. Moon Fish; Angel Fish; Porgee.

U. S. N. M. 42477, 43140, 43141. This species is frequently taken in the pound nets. At the time of our visit but few were observed. I saw several examples that were about 7 inches long. The National Museum has a good series of the young of this species, measuring from 1 to 5 inches in length. In June, 1881, Colonel M. McDonald obtained

a specimen  $3\frac{1}{2}$  inches long in the Potomac River, at Gunston, Virginia. This point is about 80 miles from the river's mouth. Prof. John A. Ryder obtained young specimens ranging from 1 to  $2\frac{1}{2}$  inches long, in the Chesapeake region in St. Jerome's Creek, Maryland, and other specimens from 1 to 2 inches in length are from Beaufort and Charleston, South Carolina, and others from Florida. This fish is to be found quite regularly in the Washington, District of Columbia, market. Its flesh is excellent food. Specimen No. 42477, taken at Cape Charles City, Virginia, is  $5\frac{1}{2}$  inches long, and has D. VIII-I, 20; A. III, 18. The third spine of the dorsal is longer than the head. The length of the eye is one-fifth that of the head. Mr. Seal saw a boy taking this species by hook and line, in the grass, in water 4 or 5 feet deep, at Cape Charles City.

**20. *Trichiurus lepturus* L. Silvery Hair-tail.**

U. S. N. M. 43188. Ten specimens, measuring from 20 to 23 inches in length. Secured from the pound nets.

The flesh of this fish is excellent eating, being white and well flavored. It is rather common in the Chesapeake, and has been taken at the mouth of the Potomac River.

**21. *Scomberomorus maculatus* Mitch. Spanish Mackerel.**

Very few of this species were being taken while we were at Cape Charles. The retail price there was 30 cents per pound. Those we observed in the pound nets ranged in length from about 12 to 24 inches.

**22. *Trachynotus carolinus* L. Pompano.**

U. S. N. M. 43183. Six specimens, measuring 4, 6,  $6\frac{1}{2}$ , 7, and 9 inches, respectively. A few very young examples, 2 inches long, were seined September 18, 1890, in the bay at Cape Charles City, and it is probable that the species is more or less common there.

**23. *Caranx chrysus* Mitch. Crevallé.**

U. S. N. M. 43164, 43193. Six specimens, measuring from  $5\frac{1}{2}$  to  $7\frac{1}{2}$  inches in length.

**24. *Trachurops crumenophthalmus* Bloch.**

U. S. N. M. 43174, 43199. Fifteen specimens,  $6\frac{1}{2}$  and 7 inches long.

**25. *Chloroscombrus chrysurus* L.**

U. S. N. M. 43192. One specimen.

**26. *Selene vomer* L. Look Down.**

U. S. N. M. 43148, 43165, 43191. Fourteen specimens, 5 to 10 inches long, taken in Sterling Brothers' pound nets, in the bay at Cape Charles City.

27. *Stromateus paru* L. Harvest Fish.

U. S. N. M. 43147, 43156, 43190. Twelve specimens, from 4 to 7 inches long. This species is known in Chesapeake Bay as butterfish, and it is sold in the markets under this name. It is one of our sweetest flavored fishes.

Mr. Seal observed but one specimen of *S. triacanthus* at Cape Charles. I saw a number in Washington, District of Columbia, market about November 1, said to come from Chesapeake Bay.

28. *Larimus fasciatus* Holbrook.

U. S. N. M. 43217. One specimen, 1 inch long. D. X-I, 24; A. II, 6.

Mr. Seal's discovery of this species in the Chesapeake extends its recorded range northward. The Museum has two specimens, No. 33162, from Charleston, South Carolina, which were collected by C. H. Gilbert. These measure  $5\frac{1}{2}$  and  $7\frac{1}{2}$  inches. Uhler and Lugger, in their list of the fishes of Maryland, published in 1876, refer to the young of *Pogonias chromis* under the name *Larimus fasciatus*. *Pogonias fasciatus* was intended.

29. *Cynoscion regalis* Bl. & Schn. Weakfish.

This species is known as trout, or gray trout, in the Chesapeake, and it is a very important fish to the fishermen. They are taken in the pound nets, and those caught at the time of our visit ranged from 1 to 3 pounds in weight. Mr. Seal obtained this species from the pounds at Point Lookout in May, 1889; and at St. Jerome's in September, 1889, observed specimens ranging in length from 6 to 15 inches. It occurs in the Potomac as far up as Lower Cedar Point. The water at this point is quite fresh, being probably never above 1.05.

30. *Cynoscion maculatus* Mitch. Spotted Sea-trout.

U. S. N. M., 43159. Two specimens, 8 and 9 inches in length.

This species was rather rare at Cape Charles City at the time of Mr. Seal's visit. On September 20, 1890, I saw a fair supply of this fish in the Norfolk, Virginia, market. These market specimens ranged in weight from 1 to 5 pounds. According to the dealers, they are seldom seen over 5, although they sometimes have specimens weighing 10 pounds.

Mr. Seal notes that the young sea trout, 3 to 6 inches long, were abundant at St. Jerome's in September, 1889.

31. *Bairdiella chrysura* Lac. Yellow-tail.

U. S. N. M., 43175, 43194, 43214. Sixteen specimens, ranging from 7 to  $8\frac{1}{2}$  inches in length.

Mr. Seal obtained specimens measuring 1 and  $1\frac{1}{2}$  inches in length at Point Lookout, May 17, 1889, and others, from 2 to 5 inches long, at St. Jerome's in September, 1889. This is called silver perch in many localities.

32. *Menticirrhus alburnus* L. Whiting.

U. S. N. M., 43155, 43180. Four specimens, from 9 to 12 inches long.

The kingfish, *M. nebulosus*, was not secured at Cape Charles, but Mr. Seal reports it as abundant at St. Jerome's in September, 1889, ranging from 1 to 6 inches in length. He took it at Point Lookout in May, 1889, also.

33. *Liostomus xanthurus* Lac. Spot.

U. S. N. M., 43138, 43139. Two specimens.

Large numbers of young spot from 3 to 4 inches in length were seined in the bay at Cape Charles City. They were present in abundance, numerous schools being seen. Mr. Seal collected the young, 1½ inches long, in the Lower Potomac in May, 1889, and found the species, from 3 to 6 inches long, abundant at St. Jerome's, Maryland, in September. As a pau fish, the spot is the most highly prized of all fishes sold in the Norfolk market. It is very hardy as an aquarium fish, and Mr. Seal experiences no trouble in transporting and keeping them alive in Washington.

34. *Micropogon undulatus* L. Croaker.

U. S. N. M., 43132, 43158.

This fish, like the spot, was taken in the shallow waters of the bay at Cape Charles City, in rather large numbers. It ranged in size from 3 to 8 inches, those from 3 to 5 being very common. Larger specimens were taken in the pound nets.

Young specimens, from 1 to 1½ inches long, were collected by Mr. Seal in the Lower Potomac in May, 1889, and larger ones, 3 to 6 inches long, were taken at St. Jerome's in September, 1889.

35. *Sciaenops ocellatus* L. Red Drum.

U. S. N. M., 43130. One specimen, 16 inches long; weight, about 2½ pounds. This species was seined in a quiet cove of the bay, near Cape Charles City, at night. Quite a number, about 16 inches long, were obtained and brought to Washington, where they do well in the marine aquaria. Mr. Seal observed them as large as 30 inches or more from the pounds.

I was very much surprised at the great abundance of red drum in the Norfolk and Portsmouth, Virginia, markets on September 20, 1890. Cart loads of this species were to be seen, especially in Portsmouth. The fish ranged in weight from 1 to 3 pounds, and were packed into the carts as thickly as they could be placed standing on their heads or tails. No ice was used on them.

In November, 1890, Mr. Joseph Ragan, of the Washington market, called my attention to a red drum, which had, besides the two black spots on the caudal fin, three similar marks on either side of the body,

those of the right side being very close together, while the ones of the left side were farther apart; the body spots being the same, white edged, as the one at the root of the tail, which is seldom, if ever, absent.

36. *Archosargus probatocephalus* Walb. Sheephead.

U. S. N. M., 43187. One specimen, 4 inches long. Mr. Seal obtained a few young examples of this species. A few days before our arrival at Cape Charles City a hook and line fisherman had taken six fine sheephead along the piles forming the breakwater at that place. In May, 1889, Mr. Seal failed to secure this species in the Lower Potomac. At St. Jerome's, Maryland, in September, 1889, he purchased a specimen measuring 20 inches, which had been captured on a ledge near Point Lookout. The fishermen at this point receive 17 cents per pound for sheephead.

This valuable species seems destined to extinction in our northern waters. The outrageous practice of dynamiting fish on the New Jersey coast has driven it away from places where a few years ago it was moderately abundant.

37. *Diplodus holbrookii* Bean. Holbrook's Scup.

U. S. N. M., 42486, 43152, 43198. Seven specimens. A small number of this beautiful scup were seined, and Mr. Seal succeeded in bringing several living individuals to Washington. A distinctive mark of this species is the black blotch around the caudal peduncle.

D. XII, 14; A. III, 14. Scales in lateral line 55. Length of specimens, 4 and 5 inches.

38. *Stenotomus chrysops* L. Scup.

U. S. N. M., 42490, 43184. Five specimens, from 5 to 8 inches long.

Very few of the common scup were seined by us at Cape Charles City, and in the Norfolk market the species was equally rare, September 20, 1890. A dealer gave me the name "maiden" for a scup about 8 inches long.

39. *Lagodon rhomboides* L. Fair-maid.

U. S. N. M., 42489, 43157, 43189. Numerous specimens, from 5 to 6½ inches long. This species was seined in the bay at Cape Charles City in large numbers. It is very beautiful in life and a hardy fish for the aquaria. At Cape Charles City it is called fair-maid, a very appropriate name, owing to its pleasing colors.

40. *Orthopristis chrysopterus* L. Pig-fish.

U. S. N. M., 43135. Fourteen specimens, ranging in length from 3 to 6 inches. A specimen 11 inches long was obtained by Mr. Kenly in Norfolk. Its vulgar name is derived from its annoying habit of stealing bait off hooks.

**41. *Lutjanus caxia* Bl. & Schn. Gray Snapper.**

U. S. N. M., 43209. Three young specimens,  $1\frac{1}{2}$  and 2 inches long. D. X, 14; A. III, 8.

Color: Upper parts dark bluish; sides olive; throat, pectorals, ventrals, and caudal pale; dorsal and anal spotted; membrane of spinous dorsal edged with black. A blue stripe as wide as the pupil extends from the snout through the eye to end of head. The dark spots on scales form longitudinal stripes on body.

**42. *Centropristis striatus* L. Sea Bass.**

U. S. N. M., 43143, 43171, 43211. Ten specimens, from  $1\frac{1}{2}$  to 7 inches long.

This fish is called Black Will at Cape Charles City, while at St. Jerome's, Maryland, Mr. Kenly tells me they call it Black Nell. Those observed by us were small, requiring three or four fish to the pound. Very young specimens, from 2 to 4 inches long, were common in the seine. A few individuals weighing about 1 pound each were taken at the end of the breakwater.

According to Mr. Seal the sea bass is taken in the Potomac River as far up as the Wicomico River. It occurs also in Breton's Bay, near Leonardtown, Maryland, and at Point Lookout he collected a number ranging in length from 6 to 7 inches.

**43. *Pomatomus saltatrix* L. Bluefish.**

U. S. N. M., 43134, 43167. Two specimens, 8 inches long.

This is the "tailor" of Chesapeake Bay. The young, from 3 to 8 inches long, were very abundant around the wharves at Cape Charles City. Few large bluefish were being taken in the pound nets at the time of our visit. Earlier in the season the fishing was much better. From the 19th to the 21st of September, 1889, Mr. Seal found the young, measuring from 5 to 8 inches in length, quite abundant along the wharves at St. Jerome's, Maryland, and in the Potomac River as far up as Lower Cedar Point.

**44. *Elacate canada* L. Crab-eater.**

U. S. N. M., 43145, 43161. Fourteen specimens, ranging from 11 to 14 inches in length.

This species is called "bonito" in the Chesapeake. It is taken in the pound nets. Mr. Seal saw this fish from the pounds measuring at least 3 feet in length. In 1889 I saw a specimen in the Washington, District of Columbia, market, which measured more than 4 feet in length, and probably weighed as much as 35 pounds. Specimens ranging from 2 to 3 feet are common in this market during the summer months.

45. *Menidia notata* Mitch. Silverside.

U. S. N. M., 43213. This species was abundant at Cape Charles City. Mr. Seal found it in abundance in the Lower Potomac, May 16, 1889, and at St. Jerome's, Maryland, September 19-21, ranging in length from 1½ to 5 inches. Its chief value is as food for larger fishes.

46. *Mugil curema* Cuv. & Val. Gray Mullet.

U. S. N. M., 42480. Two specimens.

47. *Mugil albula* L. Striped Mullet.

U. S. N. M., 43137. One specimen, 9 inches long.

Called jumping mullet or fat back. Mr. Seal found the young mullets, 3 to 10 inches in length, exceedingly abundant. About September 25, he took about five thousand in one seine haul in the bay at Cape Charles City. The mullets are hardy and attractive for aquaria. The species was abundant in the Norfolk market, September 20, 1890, and the writer saw some in the Washington, District of Columbia, market about November 1. The species was reported as abundant on the North Carolina coast in 1890, where the bluefish devoured them by the thousands.

48. *Hemirhamphus pleei* Cuv. & Val. Half-beak.

U. S. N. M., 43185. Fourteen specimens, from 12 to 16 inches long.

This species was very abundant in the bay at Cape Charles City, and was seined in large numbers in shallow water. They are not hardy, and none of them reached Washington alive.

49. *Hemirhamphus roberti* Cuv. & Val.

U. S. N. M., 43178, 43195. Four specimens, 6½ inches long.

This species was not near so common as the *H. pleei*. Half-beaks were observed by Mr. Seal at Point Lookout, Maryland, May 17, 1889.

50. *Tylosurus marinus* Bl. & Schn. Silver Gar.

U. S. N. M., 43186. Nine specimens, from 12 to 14 inches long.

Common at Cape Charles City. Mr. Seal observed the species at Point Lookout in May, and at St. Jerome's in September 1889. I have observed the species in the Potomac River at Washington.

51. *Fundulus majalis* Walb. Mummichog.

Moderately common.

52. *Fundulus heteroclitus grandis* Bd. & Grd.

U. S. N. M., 42495. One specimen. Common, especially in the shallow water back of the docks.

In May, 1889, Mr. Seal obtained this species, besides *F. diaphanus*, *majalis*, *Cyprinodon variegatus*, *Lucania parva*, and *Gambusia patruelis* in the Lower Potomac, from Lower Cedar Point to Point Lookout.

**53. *Synodus foetens* L. Lizard Fish.**

U. S. N. M., 42479, 43144. Seventeen specimens, from 6 to 10 inches long.

Mr. Seal found this fish to be common at St. Jerome's in September, 1889. The fishermen called it scorpion, pronounced "scarpén," and its bite is feared by the colored people. Other common names elsewhere in use are, cigar fish, spear fish, sand diver, etc.

**54. *Elops saurus* L. Big-eyed Herring.**

U. S. N. M., 43149, 43150. Two specimens, 12 and 13½ inches long

Mr. Seal tells me that this species is called lady fish at Cape Charles City.

**55. *Opisthonema oglinum* Le S. Thread Herring.**

U. S. N. M., 43205. Three specimens, 5 inches long.

**56. *Brevoortia tyrannus* Latrobe. Menhaden.**

U. S. N. M., 43136. This species is known as old wife in the Chesapeake at Cape Charles City. On the way to the pound nets we saw many schools, some of which were very large. The nets were full of them. Being of no use to the fishermen as food fish, the menhaden were thrown back into the bay. Mr. Sterling, of Sterling Brothers, told us that there were more menhaden in the bay than had been seen for years. Notwithstanding the great abundance of this fish there was a scarcity of bluefish, Spanish mackerel, weakfish, and crab-eaters ("bonito"). In May, 1889, Mr. Seal obtained the menhaden in the Lower Potomac, and in September at St. Jerome's, Maryland. At the latter place they ranged in length from 2 to 8 inches.

**57. *Stolephorus browni* Gmelin. Anchovy.**

U. S. N. M., 43224. Thirty-seven specimens, 3 to 4 inches long. Anal 20. Abundant in coves, where they are fed upon voraciously by the weakfish.

As a delicacy the anchovy is probably the best fish of our waters.

**58. *Stolephorus mitchilli* Cav. & Val. Anchovy.**

U. S. N. M., 43223. Fifty specimens, 1 to 2½ inches long. Anal 27.

Mr. Seal took the anchovy in the Wicomico River, Lower Potomac, May 16, 1889, and at St. Jerome's in September, 1889, where he records it as not abundant. It was found from one-half to 3 inches in length.

**59. *Conger conger* L. Conger Eel.**

A few examples were taken in the Atlantic, near Cobb's Island, and brought alive to Washington. The species was not observed in the Chesapeake.



60. *Anguilla rostrata* De Kay. Eel.

U. S. N. M., 43196. One specimen, 4 inches long.

Mr. Seal found the common eel to be everywhere abundant in the Lower Potomac, in May, 1889, ranging in length from 1 to 3 feet, and at St. Jerome's, Maryland, in September, 1889, specimens from 3 inches to 2 feet in length were abundant.

61. *Scoliodon terræ-novæ* Rich. Sharp-nosed Shark.

U. S. N. M., 42491. One specimen. Length, 20½ inches.

Sharks, rays, and skates are common in the Chesapeake at Cape Charles City. The capture of *Raia*, *Pteroplatea*, *Rhinoptera*, and blue sharks is of ordinary occurrence in the pound nets. They are used as bait for crabs:

62. *Raia lævis* Mitch. Barndoor Skate.

U. S. N. M., 42500. One specimen. Length of disk, 10 inches; width, 13 inches; length of tail, 10 inches. Secured in the pound nets of Sterling Brothers.

63. *Pteroplatea maclura* Le S. Butterfly Ray.

U. S. N. M., 42502. One specimen. Disk, 9 inches long; tail, 3 inches; width of disk, 16 inches. Secured in the pound nets of Sterling Brothers.

64. *Rhinoptera quadriloba* Le S. Cow-nosed Ray.

U. S. N. M., 42499. One specimen. Length to caudal spine, 12 inches; length of tail, measured from spine, 21 inches; width of disk, 19 inches. Two serrated caudal spines; the first but half an inch in length, the second 1½ inches. Width of mouth, 2 inches.

LIST OF NORTH AMERICAN LAND AND FRESH-WATER SHELLS  
RECEIVED FROM THE U. S. DEPARTMENT OF AGRICULTURE,  
WITH NOTES AND COMMENTS THEREON.

BY

ROBERT E. C. STEARNS,

*Adjunct Curator of the Department of Mollusks.*

The following list includes a number of molluscan forms received at various times by the U. S. National Museum from the above Department, being the collections made by Dr. C. Hart Merriam, in charge of the Division of Biological Explorations, and by his assistants, during the years 1889-'90. The list contains the names of a few species not before collected, which have been described by the writer in a previous volume of the Proceedings of the National Museum; and further, many interesting facts pertaining to the geographical distribution of some of the forms not before made known.

Class GASTROPODA.

Order PULMONATA.

Sub order GEOPHILA.

*Glandina decussata* Desh.

Painted Cave, mouth of the Pecos River, Texas. William Lloyd. (Mus. No. 118385).

Two examples of the above were detected at this locality; one fresh and in fine condition, the other bleached and broken. The species seems to be tolerably well characterized for a *Glandina*, though there is scarcely a doubt that too many have been made in this group.

*Vitrina pfeifferi* Newc.

Bridger's Pass, Wyoming, "near a spring in the cañon;" several examples. V. Bailey (Mus. No. 118484.)

*Helix (Patula) striatella* Anth.; var. *Cronkhitei* Newc.

Bridger's Pass, Wyoming, edge of a "spring in the cañon." V. Bailey. (Mus. No. 118481.)

*Helix (Patula) strigosa* Gld.

Wyoming, Bridger's Pass, May, 1890 (Mus. No. 118474); also in the Uintah and Wahsatch Mountains at Park City, Utah, June, 1890. Vernon Bailey. (Mus. No. 118371.)

Several characteristic examples were found by Mr. Bailey "on the hills along the cañon" at the first-named locality.

*Helix (Patula) hemphilli* Newc.

Needle Peak, Lost River Mountains, Idaho, "among rocks at an altitude varying from 8,000 to 11,000 feet." Bailey & Dutcher, August, 1890. (Mus. No. 118392.)

Several examples of this form, now regarded as an extreme variety of the protean *strigosa*, were detected as above by Dr. Merriam's collectors. Compared with the typical *strigosa*, its relations are analogous to those of *H. (Patula) Cumberlandiana* Lea to *H. (Patula) alternata* of Say. Of the direct gradation of the alleged species, more properly intermediate and blending varieties, to which the names of *Fergusonimordax* and *Cumberlandiana* have been given, it may be said that a sufficiently large series tells its own story, and the examples in the National Museum point to such a connection.

*Helix (Polygyra) texasiana* Mor.

Texas, near Sanderson (Mus. No. 118364); vicinity of Eagle Pass (Mus. No. 120346); Comstock (Mus. No. 118401); also at Painted Cave, near the mouth of the Pecos (Mus. No. 118390). William Lloyd. Del Rio, on dry land in the valley of the Rio Grande (Mus. No. 118369), Vernon Bailey.

Several examples of the flat variety of this well-known snail shell, with the sculpture only moderately developed, were obtained at Sanderson. The others are as usual as to elevation and sculpture.

*Helix (Pomatia) humboldtiana* Val.

Texas, at Altuda, at an elevation of 5,000 feet, where it, a single specimen in fair condition, had been thrown out with soil by a prairie dog. (Mus. No. 118366.) William Lloyd.

This species has not before been reported from any locality within the territory of the United States. It was described from Mexico where it is found in the neighborhood of the City of Mexico and in other localities. The national collection contains several examples from the Real del Monte. It has a pretty close resemblance to some of the varieties of the European *H. (Pomatia) pomatia*, and it may possibly be an introduced form. *H. pomatia* has for centuries been esteemed as an article of food in various parts of Europe, and was regarded as a dainty by the ancient Romans. It was propagated and raised in large quantities for their use and specially fed on certain plants to give the flesh a particular flavor.

Unmistakable specimens of another favorite edible snail common to Europe, *H. (Pomatia) aspersa*, is found in Mexico, and examples from

Puebla, in the province of Puebla, Mexico, were presented to the National Museum by the Mexican Geographical Commission a few years ago. The presence of these two forms most certainly suggests the question as to whether they were not introduced by the Spaniards many years, centuries ago, either for food purposes or incidentally in the routine and accidents of commercial intercourse.

*Helix (Arionta) coloradoensis* Stearns.

Grand Cañon of the Colorado, opposite the Kabab Plateau, at an elevation of 3,500 feet (Mus. No. 104100). Dr. C. Hart Merriam.

Described in the Proceedings of the U. S. National Museum, vol. XIII, p. 206, Figs. 6, 7, 8, Pl. xv.

*Helix (Arionta) magdalenensis* Stearns.

Magdalena, State of Sonora, Mexico, on the line of the Sonora, New Mexico and Arizona Railroad, at an elevation of 1,000 feet above the town (Mus. No. 104094); Vernon Bailey.

Described in the Proceedings of the U. S. National Museum, vol. XIII, p. 207-208, Figs. 11, 12, 13, Pl. xv.

*Bulimulus dealbatus* Say.

Texas, near Sanderson (Mus. No. 118365); also from near Eagle Pass (Mus. No. 120345). William Lloyd.

Three examples of a small variety of this form, of which one individual, in the prominence of its incremental lines, indicates the relationship of Mr. Pilsbry's *B. ragsdalei*. The foregoing applies equally well to the Eagle Pass examples, six in number. The Sanderson specimens are of a dead, chalky whiteness; the Eagle Pass lot are marked more or less with irregular blotchy stripes of a pale corneous brown color.

*Bulimulus dealbatus* Say; var. = *B. ragsdalei* Pilsbry.

Comstock, Texas, William Lloyd (Mus. No. 118402); Langtry, in the same State, Vernon Bailey (Mus. No. 118367).

Four specimens of this variety of *dealbatus* were collected at the first-named locality. These differ from Mr. Pilsbry's shells only in the matter of color, the examples before me being of an opaque white, with an occasional pale brownish longitudinal streak. The largest individual shows considerable angulation on the basal whorl just below and following the suture, and there is considerable variation in robustness. The longitudinal ribs consist of more or less strongly developed growth lines, which are distinct and definite throughout and over the entire shell in Mr. Lloyd's specimens; more conspicuous in the largest example, which is the one above referred to as showing angulation. The author says of *B. ragsdalei*, "that no specimens showing a transition to *B. deal-*

*batus* or *schiedeanus* were found, nor have I ever seen any, although I have collected thousands of *Bulimuli* in Texas," etc.

The National Museum is indebted to Mr. Pilsbry for an example of the original lot from Montague County, Texas (Mus. No. 118361), in which the sculpture described by the author is so sharply developed, that without intervening and connecting specimens it might well be regarded as a new form.

With his specimen and comments before me, I was led to examine the large geographical series of *dealbatus* and related species, and found that in certain examples from Texas (Mus. No. 26411) collected by Dr. Shumard many years ago, the *upper whorls* of two, and *nearly the whole of the third*, show this ribbing; in the first two the corneous ground color prevails. In another lot, also from Texas, collected years ago by General (then Lieutenant) Couch, U. S. Army, the specimens are unusually elongated (No. 26415), and one of them exhibits conspicuous growth lines. In two examples (No. 29614), of rather delicate texture, the corneous character and coloration dominates, with opaque longitudinal streaks of whitish color; the upper whorls in these are ribbed. The same also in four specimens (No. 30696) from Texas, collected by Lieutenant Beale. In another tube (No. 31625) three of the eight specimens are ribbed. Three out of eight examples from Leon, Texas (No. 26410), exhibit this feature, and two out of five from Dallas, Texas (No. 26413), have the same sculptural peculiarity.

In specimens from Clifton, Texas (No. 30240), the upper whorls are ribbed, and the ribbing continues down to and upon the upper part of the basal whorl just below the suture. So in examples from San Felipe Springs (No. 26569), collected by Lieutenant Beale, six of the seven may be regarded as the variety *ragsdalei*.

Mr. C. T. Simpson collected specimens in Limestone Gap, Indian Territory (No. 101062), and four of the examples show distinct ribbing on the upper whorls; so also with specimens from Matamoras, Mexico (U. S. Mus. No. 26407), of *alternatus*, two specimens, and others from Tamaulipas, Mexico (No. 26566), of this last named species.

A single example of the variety *ragsdalei* was collected by Mr. Bailey, who detected it in a cañon of the Rio Grande at Langtry, Texas. *B. ragsdalei* suggests the Asiatic form *B. abyssinicus* Ruppel (≡ *B. fairbanksi* Blfd.), from Bombay, which not unlikely sometimes occurs with inconspicuous growth lines like the ordinary form of *dealbatus*. When the physical peculiarities of the region inhabited by *dealbatus*, *alternatus*, etc., are considered we may reasonably look for a wide range of variation in form, size, sculpture, etc., and it is highly probable that individuals, if not colonies, with more striking characteristics than any yet collected, will sooner or later be discovered.

*Bulimulus alternatus* Say.

- = *Bulimus alternatus* Say, 1830.
- + *Bulimus Schiedeianus* Pfr., 1854.
- + *Bulimus patriarcha* W. G. B., 1858.
- + *Bulimus marie* Albers, 1858.
- + *Bulimus mooreanus* Pfr., 1868.

The last four names which have been given to this exceedingly variable form I regard as synonyms, and an examination of the ample material in the national collection points to and warrants this conclusion. I am under the impression that Mr. Binney is now of this opinion. Mr. J. A. Singley, of Giddings, Texas, and Mr. C. T. Simpson, of the National Museum, who have collected large numbers of these so-called species in Texas and the Indian Territory, consider the foregoing, as well as *B. dealbatus* Say, as one and the same species. I am not prepared to go quite so far at the present moment; perhaps further comparison and study may lead me to the same conclusion. The synonyms may be regarded as representing varietal aspects, and it is not surprising that so mutable a form should have received so many names. The years in which these descriptions were published, taken from Binney's Manual,\* have been given for the convenience of students. Distribution: Indian Territory, Texas, Louisiana, Mexico.

Dr. Merriam's collectors have found it in the following places in Texas: Painted Cave, mouth of the Pecos River (Mus. No. 118386); Comstock (Mus. No. 118400), near Eagle Pass (Mus. Nos. 120343, 120344), William Lloyd; in the valley of the Rio Grande, "at Del Rio, among brush on high ground that is never flooded" (Mus. No. 118370); also at Langtry (Mus. No. 118368), Vernon Bailey.

The specimens collected by Mr. Bailey at Del Rio include examples with a dull chalk white and others with a smooth porcelaneous surface with an occasional individual faintly colored with yellowish brown in obscure irregular longitudinal bands. The color of the aperture varies from nearly white, yellowish, and yellowish brown to dark chocolate. Some examples are robust, others elongated. Some approach the form to which Mr. Binney gave the name *patriarchus*, others are nearer to *dealbatus*. The shells vary much in solidity, some being thicker and heavier than others. In most instances the columella is simple without a wave, subplait, or fold; this part of the shell being straight, while in others the pillar exhibits a partial twist, suggesting a fold or modified plait. The umbilical feature is also variable, being more open in some specimens than in others. The deposit of callus on the pillar is sometimes so heavy as to connect the edges of the outer lip and produce a peristome. In some the incremental lines are fine, in others coarse, and occasionally a specimen is met with that is partially traversed by a fine grooved line parallel to and just below the suture. The finest examples in the National Museum were collected at Painted

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\* Bulletin 28, U. S. National Museum.

Cave by Mr. Lloyd, and are of unusual size. The remarks following Mr. Bailey's Del Rio specimens apply equally well to these.

***Holospira Roemeri* Pfr.**

Painted Cave, mouth of the Pecos River, Texas. (Mus. No. 118388.) Two examples; also in the Devil's River region, Texas, a single specimen (Mus. No. 118393). William Lloyd.

Number of whorls, varying from thirteen to sixteen, and the specimens also show some difference in robustness.

Previously reported from Texas by Mr. W. G. Binney, who also notices the point that some individuals are more ventricose than others, and that the number of whorls varies from "twelve to fourteen."

***Holospira arizonensis* Stearns.**

Dos Cabezas, Arizona, two specimens and numerous fragments collected by V. Bailey November, 1889 (Mus. No. 104392).

Described in the Proceedings of the United States National Museum, pp. 208-11, vol. XIII, Figs. 2, 3, Pl. XV.

***Succinea luteola* Gould.**

Texas, Painted Cave, mouth of the Pecos River, William Lloyd (Mus. No. 118391). Arizona, near Wilcox, on dry alkali flats, November, 1889, Vernon Bailey (Mus. No. 118373).

The bleached aspect resulting from these alkaline and arid stations is also seen in examples of *Succinea* that inhabit sandy reaches along the seaboard where the vegetation is sparse and its substance ligneous rather than succulent and more saline than in places farther from the sea.

***Succinea avara* Say.**

Bridger's Pass, Wyoming, "near a spring in the cañon." V. Bailey (Mus. No. 118483).

***Succinea campestris* Say.**

Texas, near Sanderson, William Lloyd (Mus. No. 118363).

**Suborder HYGROPHILA.**

***Limnæa stagnalis* Linn.**

Nevada, various places.

This well known European species, like its congener *L. palustris*, has a wide distribution in North America. We are indebted to Mr. Bailey for specimens from the East Humboldt River at Elko, Nevada (Mus. No. 120910), also from the same stream near Battle Mountain, Nevada (Mus. No. 120909).

***Limnæa palustris* Müll.**

Nevada, Idaho, California, Arizona, etc.

The exceedingly wide distribution of this form is well known. It may be regarded as the parent stock from which a great number of varieties

have originated, many of which have received specific names. Mr. Binney\* has included several of these alleged species in the synonymy of *palustris* and many more will have to be added whenever a thorough revision of the *Limnæidæ* and related groups is made. Mr. Binney has also given several figures which serve to show the variability of this protean form, but as many more would hardly represent the intermediate aspects.

The commoner West American variety of the above is generally known to collectors as *Limnæa Nuttalliana* Lea (Mus. No. 104095). It was found in great abundance in Walker Lake, San Francisco Mountain, Arizona Territory, by Dr. Merriam in 1889. This lake occupies the crater cavity or basin of an extinct or passive volcano, and the elevation of the lake is about 8,250 feet above the sea level. Mr. Bailey collected *palustris* in the Uintah Mountains (Mus. No. 118376), where he detected it "in a creek at an elevation of 10,000 feet."

A single low-spired and rather ventricose example of this species, close to specimens from southern Utah collected by Dr. Yarrow (Mus. No. 47770), and quite black and malleated, like specimens from Ione Valley, California, collected by C. D. Voy (Mus. No. 47690), was found by Dr. Merriam's collectors in Saw-tooth Lake, Idaho, in September, 1890. One example exhibits a serial regularity in the malleation suggestive of rude obsolete spiral ribbing, stronger on the basal whorl (Mus. No. 120354).

Several living examples, dwarfed but apparently mature, were also collected in Salmon River near Challis, Idaho, by Merriam and Bailey (Mus. No. 120356). They are all of a dark amber color and quite uniform in size. The more ventricose individuals approach closely to certain specimens of *L. Adelineæ* Tryon, and are, save in color, like the examples of *L. palustris* collected by Mr. Dall some years ago at Bay View, near San Francisco (Mus. No. 43321). Mr. Vernon Bailey collected several specimens in Nevada, in East Humboldt River near Elko (Mus. No. 120912); also in the same stream near Battle Mountain (Mus. No. 120911).

Mr. Dall has recently collected an interesting variety of this species in the irrigation ditches near Hot Springs, in Honey Lake Valley, Lassen County, California, which is within the area of the extinct Tertiary Lake Lahontan (Mus. No. 118561). Mr. Dall's shells exhibit a most delicate sculpture, composed of very fine and close set incremental lines crossed by transverse and somewhat waved and slightly incised grooves, much resembling the delicate sculpture of some of the Mexican *Glandinas*. This peculiar sculpture is not infrequent in other species of *Limnæa*; notably in *L. lepida* Gould, *L. ampla* Mighels, *L. Sumassi* Baird, and occasionally in *L. columella* Say, *L. caperata* Say, and *L. lanceata* Gould, and sometimes most likely in other species of the group.

\* Land and Fresh-water Shells of North America, Part II, Series 2, Misc. Coll., 143.



*Limnæa lepida* Gould.

Idaho, Salmon River, near Challis, September, 1890 (Mus. No. 120351). Merriam and Bailey.

A single example, distinctly characteristic, as seen at once by a comparison with the type (Mus. No. 5541) in the national collection from Oregon.

The form, to which Lea's name *Nuttalliana* is usually attached, and which is so abundant on the west coast in California and the other Pacific States, and which frequently attains a large size, is really a maximum aspect of Gould's *lepida*, and is specially noticeable for the expanded or effuse aperture. As Lea's name has priority of 6 years, it may be more proper to say that Gould's *lepida* is a local and varietal form of *Nuttalliana*. Without extending this comment further as to the relationship of these with *palustris*, the main difference as between typical *lepida* and *Nuttalliana* is the more sturdy aspect and flaring mouth of the latter; as to where *Nuttalliana* leaves off and *palustris* begins it would be inconvenient to demonstrate at this time. Mr. Binney has included Lea's species in his synonymy of *palustris*, and I do not hesitate to concur in this arrangement.

*Limnæa Adelinæ* Tryon.

Idaho, Salmon River, near Challis, September, 1890. Merriam and Bailey. (Mus. No. 120353.)

Two examples hardly mature of the form to which Tryon gave the above name and agreeing with the types from near San Francisco, California (Mus. No. 24879).

*Planorbis trivolvis* Say, var.

Nevada, East Humboldt River, near Battle Mountain (Mus. No. 120915), Elko from the same stream (Mus. No. 120916). Vernon Bailey.

A few examples of the above, approaching the *corpulentus* aspect, with sharply defined incremental sculpture, were obtained at the above localities.

*Planorbis trivolvis* Say, var.

= *P. plexata* Ingersoll.

Idaho, Saw Tooth Lake, October, 1890 (Mus. No. 120348), Merriam & Bailey.

The varietal aspect is exhibited in the distorted twist in the coil of the earlier whorls. This distortion, which is shown by all the examples, eight in number, does not continue to or affect the shape of the aperture, for, curiously enough, the animal, as maturity approaches, gets back, if I may use the expression, to the ordinary or symmetrical plane of coil.

*Planorbis tumens* Cpr.

Arizona Territory, at Phoenix (Mus. No. 103623), Mr. Bailey.

This species, described from Mazatlan specimens, suggests the more southern texture and general facies of *Planorbis*, and recalls *P. tumidus* Pfr., so abundant in Guatemala and Nicaragua.

*Planorbis tumidus* Pfr.

Texas, Devil's River, several examples (Mus. No. 118396), William Lloyd.

*Planorbis liebmani* Dkr.

Texas, Devil's River, one specimen (Mus. No. 118398), William Lloyd.

*Planorbis (Gyraulus) parvus* Say.

Arizona, Walker's Lake (Mus. No. 103625), Dr. C. Hart Merriam; Devil's River (Mus. No. 118397), W. Lloyd.

A single example of this characteristic species was found among the numerous specimens of *Limnaea nuttalliana* collected by Dr. Merriam in the crater bowl of Walker Lake, San Francisco Mountain, during his biological exploration of the region in 1889. The national collection also contains examples from this territory, collected by Dr. Edward Palmer, and General Carlton collected it on the Colorado Desert, California, where also I detected it near Indio and at other places along the line of the Southern Pacific Railroad, in 1884.

*Physa heterostrophia* Say.

Arizona Territory, at Phoenix (Mus. No. 100351); Magdalena, Northwest Mexico (No. 103622); Idaho, Birch Creek (No. 120347); Nevada, East Humboldt River (Mus. Nos. 120907 and 120908), Vernon Bailey.

Several examples, for the most part immature, were obtained at Phoenix by Mr. Bailey, who detected them in an irrigation ditch "among moss." The Mexican examples were also found in a similar situation.

In the course of its southerly distribution this widely diffused form has been the recipient of many specific names, apparently induced more by the occult influence of politico-geographical lines upon the describer than any special differential facies of the shells themselves.

From other southerly regions the Museum series indicates the following localities: Hot Springs, Lower California (No. 47753), H. & C. R. Orcutt, March, 1882; Mexico, Puebla, Puebla; and Mizantla, Vera Cruz, Mexican Geographical Commission.

The Nevada specimens collected by Mr. Bailey (No. 120907) were from Elko. Of these there are several examples, some of which approach the form named *ampullacea* by Dr. Gould. The specific name *heterostrophia* was published by Say in 1817 under *Limnaea*. Subsequently, in 1821, *P. gyrina* was described and published.

A large series demonstrates that these alleged species interblend and merge the one into the other, so that the application of one of these names more than the other is altogether arbitrary or capricious; but as *heterostrophia* has four years' priority over *gyrina*, the former name must supersede and include the latter, as well as a great many other specific names at present in use, whenever a revision of this group is made.

*Physa gyrina* Say.

Texas, Pecos River, near Painted Cave (Mus. No. 118387). William Lloyd.

Three fresh and perfect specimens.

*Physa osculans* Hald.

Arizona, Devil's River (Mus. No. 118395), William Lloyd; Del Rio, Rio Grande Valley (Mus. No. 118375), Vernon Bailey.

## Order PROSOBRANCHIATA.

## Suborder PECTENIBRANCHIATA.

## Section TÆNI OGLOSSA.

*Fluminicola nuttalliana* Lea.

Idaho, Salmon River, near Challis (Mus. No. 120352), Merriam & Bailey.

## Suborder SCUTIBRANCHIATA.

## Section RHIPIDOGLOSSA.

*Helicina orbiculata* Say.

Painted Cave, mouth of the Pecos River, Texas, William Lloyd. Two specimens (Mus. No. 118389).

The extensive series in the national collection indicates the wide distribution of this species. From the northerly line of Indian Territory (C. T. Simpson) and middle Tennessee it extends through Arkansas and Texas, Mississippi and Louisiana, to the shores of the Gulf of Mexico at Galveston, Indianola, and elsewhere; also as far south as Tamaulipas, in Mexico; in Georgia, on the Atlantic coast; thence southward to Florida, where it has been detected by myself and others at various places. I found it under a cedar log between Tampa City and Rocky Point in February, 1869.

## Class PELECYPODA.

## Order TETRABRANCHIA.

## Suborder SUBMYTILACEA.

*Unio coloradoensis* Lea.

Mouth of the Pecos River, a single right valve of a half-grown individual. William Lloyd.

*Unio tampicoensis* Lea.

Mouth of the Rio Pecos, two left valves, adult, were obtained by Mr. Lloyd.

*Unio Popei* Lea.

Devil's River, Texas (Mus. No. 118394); also Rio Salado, near Leon, Mexico (Mus. No. 120920), William Lloyd.

A fresh specimen of this rare species was found as above by Mr. Lloyd. The late Dr. Lea described it from specimens collected by Berlandier in the Devil's River several years ago, and the Lea collection in the National

Museum (No. 85895) also contains specimens from the Rio Salado, New Mexico, collected by Lieutenant Beale. It varies in color externally from blackish brown to olivaceous green, with hints of radiating markings of lighter shade. The nacre is notably iridescent, lustrous, and translucent in Lloyd's Devil's River specimen.

*Unio umbrosus* Lea.

Mexico, in the Rio Salado, near Leon, January, 1891, William Lloyd (Mus. No. 20919).

A single large, heavy example, exceeding in size and weight the largest in the Lea collection. Dr. Lea's specimens were from the Medellin River, Mexico.

*Unio camptodon* Say.

= *U. manubius* Gould.

= *U. symmetricus* Lea.

+ *U. jamesianus* Lea.

Texas, Sous Creek, Los dos Hermanos, November, 1890, William Lloyd (Mus. No. 120921).

In the three examples collected by Mr. Lloyd we have the aspect of *camptodon* to which Mr. Lea gave the name *symmetricus*. Of the four specific names, Mr. Say's has priority; as to the propriety of regarding the others as synonyms, there is no question in the face of a comparison of the specimens in the national collection.

A varietal position is the utmost that can be conceded to these so-called species. The distribution of the form or forms of *camptodon* is principally southern. Without presenting in this place an exhaustive exhibit of localities as shown by the material in the national collection, it is sufficient to state that the first, *camptodon*, has been collected and credited to southern Illinois, in the north. Say described it from New Orleans, Louisiana; Gould's *manubius*, to Chihuahua, Mexico; Lea's *symmetricus*, to Red River, Louisiana; and the same author's *Jamesianus*, to Jackson, Mississippi.

*Margaritana margaritifera* Linn.

Nevada, East Humboldt River, October, 1890, Vernon Bailey (Mus. No. 120349); California, Plumas County, W. H. Dall (Mus. No. 118559).

A single example, with nacre bluish to reddish purple, collected by Mr. Bailey. Mr. Dall collected specimens in the Sierra Nevada, near Devil's Corral, Plumas County, California, at an elevation of 5,200 feet above the sea. The nacre a dull purple.

It is interesting to note the hypsometrical distribution of this widespread form which is found geographically diffused over the northernmost portions of the three continents, Europe, America, and Asia. It reaches an altitude higher than any of the tooth-hinged freshwater mussels, and in this feature of its distribution equals a few of the *Anodons*. Mr. Dall's specimens, I am inclined to believe, are from a greater altitude than heretofore reported.

*Anodonta Nuttalliana* Lea.

+ *A. Wahlamatensis* Lea.

+ *A. Oregonensis* Lea.

+ *A. Californiensis* Lea.

Numerous examples, generally odd valves of dead shells, including the two varieties which correspond to Dr. Lea's types of his *Nuttalliana* and *Californiensis*, were obtained in the East Humboldt River, near Battle Mountain (Mus. No. 120906), also from the same stream at Elko, Nevada (Mus. No. 120905), by Mr. Bailey. The forms *Oregonensis*, in which the dorsal wing is the least developed, and *Wahlamatensis*, which exhibits this feature conspicuously, were not distinctly represented in the lots from these places, in the mature form, though in certain valves the earlier zones of growth indicate the outlines which characterize the varieties of *Nuttalliana* to which Dr. Lea applied these last two names.

*Anodonta imbecilis* Say.

Devil's River, Texas, William Lloyd (Mus. No. 118399).

Several examples of this delicate species, so like varieties of the European *anatina* as to be difficult of separation, were found as above by Mr. Lloyd. *A. anatina* is otherwise represented elsewhere in North America by *A. fluviatilis* and other alleged species.

## Sub-order CONCHACEA.

*Sphaerium dentatum* Hald.

Nevada, East Humboldt River, at Elko (Mus. No. 120913), and near Battle Mountain, in the same stream (Mus. No. 120914), Vernon Bailey.

*Pisidium occidentale* Newc.

Bridger's Pass, Wyoming, "in a spring in cañon," Vernon Bailey (Mus. No. 118482).

## RELATIONS OF TEMPERATURE TO VERTEBRÆ AMONG FISHES.

BY

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It has been known for many years that in certain groups of fishes the northern or cold-water representatives have a larger number of vertebræ than those members which are found in tropical regions. To this generalization, first formulated by Dr. Gill in 1863, we may add certain others which have been more or less fully appreciated by ichthyologists, but which for the most part have never received formal statement. In groups containing fresh water and marine members, the fresh-water forms have in general more vertebræ than those found in the sea. The fishes inhabiting the depths of the sea have more vertebræ than their relatives living near the shore. In free-swimming pelagic fishes the number of vertebræ is also greater than in the related shore fishes of the same regions. The fishes of the earlier geological periods have for the most part numerous vertebræ, and those fishes with the low numbers (24 to 26) found in the specialized spiny-rayed fishes appear only in comparatively recent times. In the same connection we may also bear in mind the fact that those types of fishes (soft-rayed and anacanthine) which are properly characterized by increased numbers of vertebræ predominate in the fresh waters, the deep seas, and in Arctic and Antarctic regions. On the other hand the spiny-rayed\* fishes are in the tropics largely in the majority.

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\* For the purpose of the present discussion, we may regard the ordinary fishes, exclusive of sharks, ganoids, eels, and other primitive or aberrant types as forming three categories: (1) The soft-rayed or Physostomous fishes, with no true spines in the fins, with an open duct to the air-bladder, the ventral fins abdominal (the pelvis being attached only by the flesh and remote from the shoulder-girdle), cycloid scales, etc. (2) The spiny-rayed or Acanthopterygian fishes, having usually spines in the dorsal and other fins, no duct to the air-bladder, the skeleton firm, the ventrals attached by the pelvis to the shoulder-girdle, the shoulder-girdle joined to the skull, and the scales usually ctenoid or otherwise peculiar. The vertebræ among spiny-rayed fishes are larger, and therefore generally fewer in number, and their appendages (shoulder-girdle, gill arches, ribs, interspinal bones, etc.) are more specialized. The spiny-rayed fishes are usually regarded as the most specialized or "highest" in the scale of development. The question of whether, on the whole, they are "higher" or "lower" as compared with sharks and other primitive types is ambiguous, because various ideas are associated with these words "high" or

In the present paper, I wish to consider the extent to which these statements are true and to suggest a line of explanation which cover all these generalizations alike.

#### STATEMENT OF THEORY.

For the purpose of this discussion we may assume the derivation of species by means of the various influences and processes, for which, without special analysis, we may use the term "natural selection."

By the influence of natural selection, the spiny-rayed fish, so characteristic of the present geological era, has diverged from its soft-rayed ancestry.

The influences which have produced the spiny-rayed fish have been most active in the tropical seas. It is there that "natural selection" is most potent, so far as fishes are concerned. The influence of cold, darkness, monotony, and restriction is to limit the direct struggle for existence, and therefore to limit the resultant changes. In general the external conditions most favorable to fish life are to be found in the tropical seas, among rocks and along the coral reefs near the shore. Here is the center of competition. From conditions otherwise favorable to be found in Arctic regions, the majority of competitors are excluded by their inability to bear the cold. In the tropics is found the greatest variety in surroundings, and therefore the greatest variety in the possible adjustments of series of individuals to correspond with these surroundings.

The struggle for existence in the tropics is a struggle between fish and fish, and among the individuals of a very great number of species, each one acquiring its own peculiar points of advantage. No form is excluded from competition. No competitor is handicapped by loss of strength on account of cold, darkness, foul water, or any condition adverse to fish life.

The influences which serve as a whole to make a fish more intensely and compactly a fish, and which tend to rid it of every character and every organ not needed in fish life, should be most effective along the rocks and shores of the tropics.

For this process of intensification of fish-like characters, which finds its culmination in certain specialized spiny rayed\* fishes of the coral reefs, we may conveniently use the term "Ichthyization."

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"low." It is certain, however, that the spiny-rayed fishes deviate farthest from the primitive stock, and that the qualities that distinguish fishes as a group are most intensified. In other words, it is in the spiny-rayed fishes that the process of "ichthyization" or fish-forming has gone farthest. A third category would comprise the Anacanthines (cods, flounders, etc.), fishes anatomically similar to the spiny-rayed forms, but without spines to their fins, with weaker skeletons and smaller and more numerous vertebræ. They are "degenerate" or more "generalized" offshoots from the spiny-rayed types, as the eels are from some soft-rayed type.

\*The Parrot-fishes (*Scaridæ*), Trigger-fishes (*Balistidæ*), Angel-fishes (*Chaetodonidæ*), etc.

If "ichthyization" is in some degree a result of conditions found in the tropics, we may expect to find a less degree of specialization in the restricted and often unfavorable conditions which prevail in the fresh waters, in the cold and exclusion of the Polar Seas, and especially in the monotony, darkness, and cold of the oceanic abysses where light can not penetrate and where the temperature scarcely rises above the freezing point.

An important factor in "ichthyization" is the reduction of the number of segments or vertebræ, and a proportionate increase in the size and complexity of the individual segment and its appendages.

If the causes producing this change are still in operation, we should naturally expect that in cold water, deep water, dark water, fresh waters, and in the waters of a past geological epoch the process would be less complete and the numbers of vertebræ would be larger.

And this, in a general way, is precisely what we find in the examination of skeletons of a large series of fishes.

If this view is correct, we have a possible theory of the reduction in numbers of vertebræ as we approach the equator. It should, moreover, not surprise us to encounter various modifications and exceptions, for we know little of the habits and scarcely anything of the past history of great numbers of species. The present characters of species may depend on occurrences in the past concerning which even guesses are impossible.

#### HISTORICAL SKETCH.

*Günther*, 1862.—The earliest observation on record in reference to the subject in question was made by Dr. Albert Günther. He noted that among the *Labridæ*, the species of temperate waters had more vertebræ than those of the tropics. He says:\*

In those genera of *Labridæ* which are composed entirely or for the greater part of tropical species the vertebral column is composed of twenty-four vertebræ, whilst those which are chiefly confined to the temperate seas of the northern and southern hemispheres have that number increased in the abdominal and caudal portions.

*Gill*, 1863.—Shortly after, in a review of Dr. Günther's work on the Labroids,† Dr. Theodore Gill showed that this generalization was not confined to the Labroids alone, but that "it may also be extended to other families. \* \* \* This generalization is applicable to the representatives of Acanthopterygian‡ families generally, and can be considered in connection with the predominance of true Malacopterygian§ fishes in northern waters, fishes in which the increase in the number of vertebræ is a normal feature."

*Gill*, 1864.—Later,|| Dr. Gill remarked that the increase in the num-

\* Catalogue of the Fishes of the British Museum, vol. iv, p. 65.

† On the Labroids of the Western Coast of North America, Proc. Ac. Nat. Sc., Phila., 1863, p. 221.

‡ Spiny-rayed.

§ Soft-rayed; here including the Anacanthine fishes.

|| Proceedings Academy Natural Science, Phila., 1864, 147.



ber of vertebræ of *Sebastes*, a genus peculiar to the northern seas, affords an excellent example of the truth of the generalization claiming an increased number of vertebræ for the cold-water representatives of Acanthopterygians.

*Jordan*, 1886.—In 1886, in a paper before the Indiana Academy of Sciences,\* the present writer showed that in very many families the number of vertebræ decreases as we approach the tropics. So constant is this relation that it was thought that it might almost be termed a law. The writer could however suggest no adequate cause by the operation of which such changes are brought about.

*Jordan and Goss*, 1889.—In a study of the flounders, in 1889,† a table was given showing the numbers of vertebræ in the different species. From this table it was made evident that in that group of flounders,‡ which includes the halibut and its relatives, the Arctic genera§ have from 49 to 50 vertebræ. The northern genera|| have from 43 to 45, the members of a large semitropical genus¶ of wide range have 35 to 41, while the tropical forms\*\* have from 35 to 37.

In the group of turbot†† and whiffs none of the species really belong to the northern fauna, and the range in numbers is from 35 to 43. The highest number, 43,‡‡ is found in a deep water species, and the next, 41 and 40,§§ in species which extend their range well toward the north.

Among the plaices, which are all|||| northern, the numbers range from 35 to 65, the higher numbers, 52, 58, 65, being found in species¶¶ which inhabit considerable depths in the Arctic Seas. The lowest numbers\*\*\* (35) belong to shore species which range well to the south.

Concerning this matter, *Jordan and Goss* remark:

It has already been noticed by Dr. Günther and others that in certain groups of fishes northern representatives have the number of their vertebræ increased. In no group is this more striking than in the flounders.

*Gill*, 1889.—In a review ††† of the paper above mentioned, Dr. Gill considers in detail the condition of our knowledge of this subject, quoting from the various papers mentioned above, and claiming very properly that the first statement of this generalization belonged to himself rather than to Dr. Günther.

Dr. Gill further adds:

The case of the Sebastines became still more striking when Messrs. *Jordan and Gilbert* discovered that the number of vertebræ in the species of *Sebastichthys* and *Sebas-*

\* Still unpublished.

† A Review of the Flounders and Soles (*Pleuronectidæ*) of America and Europe, by David S. Jordan and David K. Goss.

‡ *Hippoglossinæ*. § *Hippoglossus* and *Atheresthes*.

|| *Hippoglossoides*, *Lyopsetta*, and *Eopsetta*. ¶ *Paralichthys*.

\*\* *Xystreurus*, *Ancylosetta*, etc. †† *Psettinæ*.

‡‡ *Monolene sessilicauda*. §§ *Lepidorhombus whiff-jagonis* and *Citharichthys sordida*.

||| *Pleuronectinæ*. ¶¶ *Glyptocephalus* and *Microstomus*.

\*\*\* *Platichthys stellatus*, *Hypsopsetta guttulata*.

††† Proceedings of the U. S. National Museum, 1888, p. 604.

*todes*, genera intermediate between the northern *Sebastes* and the tropical and subtropical representatives of the family of *Scorpanidæ*, was also intermediate.

But while claiming the generalization that there is a correlation between the increase of vertebræ and the increase of latitude among fishes, I would not assign it an undue value or claim for it the dignity of a law. It is simply the expression of a fact which has no cause for its being now known. It may be added that this generalization is true only in a general sense.

*Jordan*, 1891.—In another paper\* the present writer has said:

This increase in the number of vertebræ in northern forms has been used as a basis of classification of the *Pleuronectidæ* by *Jordan* and *Goss*, of the *Scorpanidæ* by *Jordan* and *Gilbert*, and it will doubtless prove to have a high value in the subdivision of other families which have representatives in different zones. The cause of this peculiarity of fishes of cold waters is still obscure. Probably the reduction in number of segments is a result of the specialization of structure incident to the sharper competition of the tropical waters, where the outside conditions of life are very favorable for fishes, but the struggle of species against species is most severe.

In this paper is given a table which shows that in the genera of *Labridæ*† inhabiting northern Europe and the New England waters there are 38 to 41 vertebræ, in the Mediterranean forms‡ 30 to 33, in certain subtropical genera§ 27 to 29, while in those *Labroids* which chiefly abound about the coral reefs|| the number is from 23 to 25.

*Jordan & Eigenmann*, 1891.¶—In a recent paper on the *Serranidæ* (sea-bass and groupers) it is stated that the group as a whole belongs to the tropical seas, and that it differs from the related fresh-water family of *Percidæ* by the much smaller number of vertebræ, usually 24, which is the number most common among spiny rayed fishes. Among the *Serranidæ*, however, two genera form exceptions to the general rule. One of these,\*\* with 35 vertebræ, occurs in the rivers of China, the other,†† with 36 vertebræ, in the mountain streams of Chili and Patagonia. In these two genera the numbers are materially increased, as would be expected if the rule is to hold good. There are, however, other *Serranidæ*, more or less perfectly confined to the fresh waters, and yet retaining the normal number of vertebræ. These are perhaps comparatively recent immigrants from the sea. In evidence of this is the fact that among these forms there is a perfect gradation in habits from the strictly marine,‡‡ through migratory§§ and brackish-water species|||| to those confined to the rivers and lakes.¶¶

So far as I know, the above record includes all the references to this subject yet made in ichthyological literature. We may now examine the facts in detail.

\* Review of the Labroid Fishes of America and Europe, p. 2.

† *Labrus*, *Acantholabrus*, *Ctenolabrus*, *Hiatula*.

‡ Chiefly belonging to *Symphodus*. § *Lachnolaimus*, *Harpe*, etc.

|| *Scarus*, *Sparisoma*, *Xyrichtys*, *Julis*, *Thalassoma*, etc.

¶ A Review of the Genera and Species of *Serranidæ* found in the waters of America and Europe, by David S. Jordan and Carl H. Eigenmann.

\*\* *Lateolabrax*.

†† *Percichthys*.

‡‡ *Dicentrarchus punctatus*.

§§ *Roccus lineatus*.

|||| *Morone americana*.

¶¶ *Roccus chrysops*.

## NUMBERS OF VERTEBRÆ.

## GANOID FISHES.

It may be taken for granted that the ancestry of the various modern types of bony fishes is to be sought among the Ganoids. All the fossil forms in this group have a notably large number of vertebræ. The few now living are nearly all fresh-water fishes, and among these, so far as known, the numbers range from 65 to 110.\*

## SOFT-RAYED FISHES.

Among the *Teleostei* or bony fishes, those which first appear in geological history are the *Isopondyli*, the allies of the salmon and herring. These have all numerous vertebræ, small in size, and none of them in any notable degree modified† or specialized. In the northern seas *Isopondyli* still exceed all other fishes in number of individuals. They abound in the depths of the ocean, but there are comparatively few of them in the tropics.

The *Salmonidæ*‡ which inhabit the rivers and lakes of the northern zones have from 60 to 65 vertebræ. The *Scopelidæ*, *Stomiatidæ*, and other deep-sea analogues have from 40 upwards in the few species in which the number has been counted.

The group of *Clupeidæ*§ is probably nearer the primitive stock of *Isopondyli* than the salmon are. This group is essentially northern in its distribution, but a considerable number of its members are found within the tropics. The common herring|| ranges farther into the Arctic regions than any other. Its vertebræ are 56 in number. In the shad,¶ a northern species which ascends the rivers, the same number has been recorded.

The sprat\*\* and sardine†† ranging farther south, have from 48 to 50, while in certain small herring‡‡ which are strictly confined to tropical shores the number is but 40.

Allied to the herring are the anchovies, mostly tropical. The northernmost species,§§ the common anchovy of Europe, has 46 vertebræ. A tropical species||| has 41 segments.

There are, however, a few soft-rayed fishes¶¶¶ confined to the tropical seas in which the numbers of vertebræ are still large, an exception to

\* Sixty-seven in *Polypterus*, 110 in *Calamoichthys*, 95 in *Amia*, etc.

† As is indicated by the name *Isopondyli*, from *ισος*, equal, *σπονδυλος*, vertebra.

‡ Salmon, trout, grayling, whitefish, etc.

§ Herring, shad, sprat, sardine, and their allies.

|| *Clupea harengus*.

¶ *Clupea alosa*, the European shad.

\*\* *Clupea sprattus*.

†† *Clupea pilchardus*.

‡‡ *Harengula macrophthalmia*.

§§ *Stolephorus enchrasicolus*.

||| *Stolephorus browni*.

¶¶ Among these are *Albula vulpes*, the bonefish, with 70 vertebræ, *Elops saurus*, the ten-pounder, with 72, the Grande Écaille (*Megalops cyprinoides*) with 57, and *Chanos chanos* with 72.

the general rule for which there is no evident reason unless it be connected with the wide distribution of these almost cosmopolitan fishes.

In a fossil herring-like fish from the Green River shales, I count 40 vertebræ; in a bass like or serranoid fish from the same locality 24, these being the usual numbers in the present tropical members of these groups.

The great family of *Siluridæ* or catfishes seems to be not allied to the *Isospondyli*, but a separate offshoot from another ganoid type. This group is represented in all the fresh waters of temperate and tropical America, as well as in the warmer parts of the Old World. One division of the family, containing numerous species abounds on the sandy shores of the tropical seas. The others are all fresh-water fishes. So far as the vertebræ in the *Siluridæ* have been examined, no conclusions can be drawn. The vertebræ in the marine species range from 35\* to 50; in the North American forms from 37 to 45,† and in the South American fresh-water species, where there is almost every imaginable variation in form and structure, the numbers range from 28 to 50 or more.

The *Cyprinidæ*,‡ confined to the fresh waters of the northern hemisphere, and their analogues, the *Characinidæ* of the rivers of South America and Africa, have also numerous vertebræ, 36 to 50 in most cases. I fail to detect in either group any relation in these numbers to surrounding conditions.

In general, we may say of the soft-rayed fishes that very few of them are inhabitants of tropical shores. Of these few, some which are closely related to northern forms have fewer vertebræ than their cold-water analogues. In the northern species, the fresh-water species and the species found in the deep sea, the number of vertebræ is always large, but the same is true of some of the tropical species also.

#### SPINY-RAYED FISHES.

Among the spiny-rayed fishes, the facts are more striking. Of these, numerous families are chiefly or wholly confined to the tropics, and in the great majority of all the species the number of vertebræ is constantly 24,§ 10 in the body and 14 in the tail (10 + 14).

In some families in which the process of ichthyization has gone on to an extreme degree, as in certain *Plectognath* fishes,|| there has been a

\* *Tachiarus*, *Felichthys*, etc.

† *Ictalurus*, *Ameiurus*, etc.

‡ Carp, minnows, suckers, chubs, buffalo-fishes, gudgeons, etc.

§ This is true of all or nearly all the *Serranidæ*, *Sparidæ*, *Sciænidæ*, *Chætodontidæ*, *Hamulidæ*, *Gerridæ*, *Gobiidæ*, *Acanthuridæ*, *Mugilidæ*, *Sphyrænidæ*, *Mullidæ*, *Pomacæn-  
ridæ*, etc.

|| *Balistes*, the trigger fish, 17; *Monacanthus* and *Alutera*, foolfishes, about 20; the trunkfish, *Ostracion*, 14; the puffers, *Tetraodon* and *Spheroides*, 18; *Canthigaster*, 17; and the headfish, *Mola*, 17. Among the *Pediculætes*, *Malthe* and *Antennarius* have 17 to 19 vertebræ, while in their near relatives, the anglers, *Lophiidæ*, the number varies

still further reduction, the lowest number, 14, existing in the short inflexible body of the trunkfish,\* in which the vertebral joints are movable only in the base of the tail. In all these forms, the process of reduction of vertebræ has been accompanied by specialization in other respects. The range of distribution of these fishes is chiefly though not quite wholly confined to the tropics.

A very few spiny-rayed families are wholly confined to the northern seas. One of the most notable of these is the family of viviparous surf fishes,† of which numerous species abound on the coasts of California extending to Oregon, and Japan, but which enter neither the waters of the frigid nor the torrid zone. These fishes seem to be remotely connected with the *Labridæ*‡ of the tropics, but no immediate proofs of their origin exist. The surf fishes have from 32 to 42 vertebræ, numbers which are never found among tropical fishes of similar appearance or relationship.

The case of the *Labridæ*, in which the fact was first noticed, has been already mentioned. Equally striking are the facts in the great group of *Cataphracti*, or mailed-cheek fishes, a tribe now divided into several families, diverging from each other in various respects, but agreeing in certain peculiarities of the skeleton.§

Among these fishes the family most nearly related to ordinary fishes is that of the *Scorpenidæ*.||

This is a large family containing many species, fishes of local habits, swarming about the rocks at moderate depths in all zones. The species of the tropical genera have all 24 vertebræ.¶ Those genera chiefly found in cooler waters, as in California,\*\* Japan, Chili, and the Cape of Good Hope, have in all their species 27 vertebræ, while in the single Arctic genus there are 31.†† An Antarctic genus‡‡ bearing some relation to *Sebastes* has 39.

Allied to the *Scorpenidæ*, but confined to the tropical or semitropical

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with the latitude. Thus, in the northern angler, *Lophius piscatorius*, which is never found south of Cape Hatteras, there are 30 vertebræ, while in a similar species, inhabiting both shores of the tropical Pacific, *Lophomus setigerus*, the vertebræ are but 19. Yet, in external appearance, these two fishes, are almost identical. It is, however, a notable fact that some of the deep-water *Pediculates*, or angling fishes, have the body very short and the number of vertebræ correspondingly reduced. *Dibranchius atlanticus*, from a depth of 3,600 fathoms, or more than 4 miles, has but 18 vertebræ, and others of its relatives in deep waters show also small numbers. These soft-bodied fishes are simply animated mounds, with a feeble osseous structure, and they are perhaps recent offshoots from some stock which has extended its range from muddy bottom or from floating seaweed to the depths of the sea.

\* *Ostracion*.

† *Embiolocidæ*.

‡ Wrasse fishes, old wives, parrot fishes, cunners, tautogs, redfishes, señoritas, etc.

§ Notably by the formation of a bony "stay" to the preopercle by the backward extension of one of the suborbital bones.

|| Sea scorpions, rockfishes, "rock cod," rosefishes, etc.

¶ *Scorpana*, *Sebastoplus*, *Pterois*, *Synanceia*, *Synancidium*, etc.

\*\* *Sebastichthys* and its offshoots, *Sebastes*, *Sebastes*, etc., the "rock cod" of California.

†† The rosefish, *Sebastes*.

‡‡ *Agriopus*.

seas, are the *Platycephalidae*, with 27 vertebræ, and the *Cephalacanthidae*, with but 22. In the deeper waters of the tropics are the *Peristediidae*, with 33 vertebræ, and extending farther north, belonging as much to the temperate as to the torrid zone, is the large family of the *Triglidae*,\* in which the vertebræ range from 25 to 38.

The family of *Agonidae*,† with 36 to 40 vertebræ, is still more decidedly northern in its distribution. Wholly confined to northern waters is the great family of the *Cottidae*,‡ in which the vertebræ ascend from 30 to 50. Entirely polar and often in deep waters are the *Liparididae*,§ an offshoot from the *Cottidae*, with soft, limp bodies, and the vertebræ 35 to 65. In these northern forms there are no scales, the spines in the fins have practically disappeared, and only the anatomy shows that they belong to the group of spiny-rayed fishes. In the *Cyclopteridae*,|| likewise largely arctic, the body becomes short and thick, the backbone inflexible, and the vertebræ are again reduced to 28. In most cases, as the number of vertebræ increases, the body becomes proportionally elongate. As a result of this, the fishes of arctic waters are, for the most part, long and slender, and not a few of them approach the form of eels. In the tropics, however, while elongate fishes are common enough, most of them (always excepting the eels) have the normal number of vertebræ, the greater length being due to the elongation¶ of their individual vertebræ and not to their increase in number.

In the great group of blenny-like fishes the facts are equally striking. The Arctic species are very slender in form as compared with the tropical blennies, and this fact, caused by a great increase in the number of their vertebræ, has led to the separation of the group into several families. The tropical forms composing the family of *Blenniidae*\*\* have from 28 to 49 vertebræ, while in the Arctic genera the numbers range from 75 to 100.

The Anacanthine fishes in whole or in part seem to have sprung from a Blennioid stock. Of these the most specialized group is that of the flounders,†† already described. The wide distribution of this family, its

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\* The gurnards and sea robins. The lowest numbers are found in the American genus *Prionotus*, which is chiefly tropical, the highest in *Lepidotrigla*, which is confined to southern Europe.

† Sea poachers, alligator fishes, etc.

‡ Sculpins, Miller's thumbs, etc.

§ Sea snails.

|| Lumpfishes.

¶ Thus the very slender goby, *Gobius oceanicus*, has the same number (25) of vertebræ as its thick-set relative *Gobius saporator* or the chubby *Lophogobius cyprinoides*.

\*\* Of the true *Blenniidae*, which are all tropical or semi-tropical, *Blennius* has 28 to 35 vertebræ; *Salarias*, 35 to 38; *Labrosomus*, 34; *Clinus*, 49; *Cristiceps*, 40. A fresh-water species of *Cristiceps* found in Australia has 46. Blennioid fishes in the Arctic seas are *Anarrhichas*, with 76 vertebræ; *Anarrhichthys*, with 100 or more; *Lumpenus*, 79; *Muraenoides*, 85; *Lycodes*, 112; *Gymnelis*, 93. *Lycodes* and *Gymnelis* have lost all the dorsal spines and are intermediate between the blennies and the forms called *Anacanthine*. The gradual degeneration of such northern forms may perhaps be attributed to the influence of "Paumixia" or the cessation of selection.

†† *Pleuronectidae*.

members being found on the sandy shores of all zones, renders it especially important in the present discussion. The other Anacanthine families are chiefly confined to the cold waters or to the depths of the seas.

In the Cod family\* (*Gadidæ*) the number of vertebræ is usually about 50, and in their deep-sea allies, the grenadier† or rat-tails, the numbers range from 65 to 80:

#### FRESH-WATER FISHES.

Of the families confined strictly to the fresh waters the great majority are among the soft-rayed or physostomous fishes, the allies of the salmon,‡ pike, carp, and cat-fish. In all of these the vertebræ are numerous. A few fresh-water families have their affinities entirely with the more specialized forms of the tropical seas. Of these the *Centrarchidæ* (comprising the American fresh-water sun-fish§ and black bass||) have on the average about 30 vertebræ; the pirate perch¶ 29, and the perch\*\* family, perch and darters, etc., 35 to 45, while the *Serranidæ* or sea bass, the nearest marine relatives of all these, have constantly 24. The marine family of Demoiselles†† have 26 vertebræ, while 30 to 40 vertebræ usually exist in their fresh-water analogues (or possibly descendants), the *Cichlidæ*, of the rivers of South America and Africa. The sticklebacks,‡‡ a family of spiny fishes, confined to the rivers and seas of the north, have from 31 vertebræ to 41.

#### PELAGIC FISHES.

It is apparently true that among the free swimming, or migratory pelagic fishes, the number of vertebræ is greater than among their relatives of local habits. This fact is most evident among the Scombritiform fishes, the allies of the mackerel and tunny. All of these belong properly to the warm seas, and the reduction of the vertebræ in certain forms has no evident relation to the temperature, though it seems to be related in some degree to the habits of the species. Perhaps the retention of many segments is connected with that strength and swiftness in the water for which the mackerels are preëminent.

\* Fifty-one in the codfish (*Gadus callarias*), 58 in the Siberian cod (*Pleurogadus navaga*), 54 in the haddock (*Melanogrammus æglineus*), 54 in the whiting (*Merlangus merlangus*), 54 in the coal-fish (*Pollachius virens*), 52 in the Alaskan coal-fish (*Pollachius chalcogrammus*), 51 in the hake (*Merluccius merluccius*). In the burbot (*Lota lota*), the only fresh-water codfish, 59; in the deep-water ling (*Molva molva*), 64; in the rocklings (*Gadopsis*), 47 to 49. Those few species found in the Mediterranean and the Gulf of Mexico have fewer fin rays and probably fewer vertebræ than the others, but none of the family enter warm water, the southern species living at greater depths.

† *Macruridæ*.

‡ *Cyprinidæ*, *Salmonidæ*, *Esocidæ*, *Characinidæ*, *Cyprinodontidæ*, *Siluridæ*, etc.

§ *Lepomis*.

|| *Micropterus*.

¶ *Aphredoderidæ*.

\*\* *Percidæ*.

†† *Pomacentridæ*.

‡‡ *Gasterosteidæ*.

The variations in the number of vertebræ in this group led Dr. Günther, nearly 30 years ago, to divide it into two families, the *Carangidæ* and *Scombridæ*.

The *Carangidæ*\* are tropical shore fishes, local or migratory to a slight degree. All these have from 24 to 26 vertebræ. In their pelagic relatives, the dolphins,† there are from 30 to 33; in the opahs,‡ 45; in the Brama, 42; while the great mackerel family,§ all of whose members are more or less pelagic, have from 31 to 50.

Other mackerel-like fishes are the cutlass|| fishes, which approach the eels in form and in the reduction of the fins. In these the vertebræ are correspondingly numerous, the numbers ranging from 100 to 160.

In apparent contradistinction to this rule, however, the pelagic family of swordfishes,¶ remotely allied to the mackerels, and with even greater powers of swimming, has the vertebræ in normal number, the common swordfish having but 24.

#### THE EELS.

The eels constitute a peculiar group of uncertain, but probably soft-rayed, ancestry, in which everything else has been subordinated to muscularity and flexibility of body. The fins, girdles, gill arches, scales, and membrane bones are all imperfectly developed or wanting. The eel is perhaps as far from the primitive stock as the most highly "ichthyized" fishes, but its progress has been of another character. The eel would be regarded in the ordinary sense as a degenerate type, for its bony structure is greatly simplified as compared with its ancestral forms, but in its eel-like qualities it is, however, greatly specialized. All the eels have vertebræ in great numbers. As the great majority of the species are tropical, and as the vertebræ in very few of the deep-sea forms have been counted, no conclusions can be drawn as to the relation of their vertebræ to the temperature.

It is evident that the two families most decidedly tropical in their distribution, the morays\*\* and the snake eels,†† have diverged farthest from the primitive stock. They are most "degenerate," as shown by the reduction of their skeleton. At the same time they are also most decidedly "eel-like," and in some respects, as in coloration, dentition,

\* Pampanos, amber fishes, pilot fishes, cavallas, etc.

† *Coryphæna*.

‡ *Lampris*.

§ *Scombridæ*. The mackerel (*Scomber scombrus*) has 31 vertebræ: the chub mackerel (*Scomber colias*), 31; the tunny (*Albacora thynnus*), 39; the long-finned albacore (*Albacora alalunga*), 40; the bonito (*Sarda sarda*), 50; the Spanish mackerel (*Scomberomorus maculatus*), 45.

|| *Trichiuridæ*: *Aphanopus*, 101 vertebræ; *Lepidopus*, 112; *Trichurus*, 159.

¶ *Xiphiidæ*.

\*\* *Muraenidæ*. Among the morays, *Muraena helena* has 140; *Gymnothorax meleagris*, 120; *G. undulatus*, 130; *G. moringa*, 145; *G. concolor*, 136; *Echidna catenata*, 116; *E. nebulosa*, 142; *E. zebra*, 135. In other families the true eel, *Anguilla anguilla*, has 115; the Conger eel, *Conger conger*, 156; and *Muraenesox cinereus*, 154.

†† *Ophichthidæ*.



muscular development, most highly specialized. It is evident that the presence of numerous vertebral joints is essential to the suppleness of body which is the eel's chief source of power.

So far as known the numbers of vertebræ in eels range from 115 to 160, some of the deep-sea eels\* having probably higher numbers, if we can draw inferences from their slender or whip-like forms; but this character may be elusive.

#### THE SHARKS.

The sharks show likewise a very large number of vertebræ, 130 to 150 in the species in which they have been counted. In these fishes no comparative study of the vertebræ has been made. The group is a very ancient one in geological time, and in the comparatively few remaining members of the group, the vertebræ, in fact the entire skeleton, is in a very primitive condition. The sharks are free-swimming fishes, and with them as with the eels, flexibility of body is essential to the life they lead.

#### VARIATIONS IN FIN-RAYS.

In some families the number of rays in the dorsal and anal fins is dependent on the number of vertebræ. It is therefore subject to the same fluctuations.† This relation is not strictly proportionate, for often a variable number of rays with their interspinal processes will be interposed between a pair of vertebræ. The myotomes or muscular bands on the sides are usually coincident with the number of vertebræ. As, however, these and other characters are dependent on differences in vertebral segmentation, they bear the same relations to temperature that the vertebræ themselves sustain.

#### CONCLUSION.

From the foregoing examples we may conclude that, other things being equal, the numbers of vertebræ are lowest in the shore-fishes of the tropics, and especially in those of local habits, living about rocks and coral reefs.

The cause of this is to be found in the fact that in these localities the influences of natural selection are most active. The reduction of vertebræ may be regarded as a phase in the process of specialization which has brought about the typical spiny-rayed fish.

These influences are most active in the warm, clear waters of tropical shores, because these regions offer conditions most favorable to fish-life, and to the life of the greatest variety of fishes. No fish is ex-

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\* *Nemichthys*, *Nectastoma*.

† Thus in the *Scorpenidae*, *Sebastes*, the Arctic genus has the dorsal rays xv, 13, the vertebræ 12 + 19. The tropical genus *Scorpena* has the dorsal rays xii, 10, the vertebræ 10 + 14, while the semitropical genus *Sebastichthys* has the intermediate numbers of dorsal rays xii, 12, and vertebræ 12 + 15.

cluded from competition. There is the greatest variety of competitors, the greatest variety of fish-food, and the greatest variety of conditions to which adaptation is possible. The number of species visiting any single area is vastly greater in the tropics than in cold regions.

A single drawing of the net on the shores of Cuba\* will obtain more different kinds of fish than can be found on the coasts of Maine in a year. Cold, monotony, darkness, isolation, foul water; all these are characters opposed to the formation of variety in fish-life. The absence of these is a chief feature of life in the tropical waters.

The life of the tropics, so far as the fishes are concerned, offers analogies to the life of cities, viewed from the standpoint of human development. In the same way, the other regions under consideration are, if we may so speak, a sort of ichthyological backwoods. In the cities, in general, the conditions of individual existence are most easy, but the competition is most severe. The struggle for existence is not a struggle with the forces and conditions of nature. It is not a struggle with wild beasts, unbroken forests, or a stubborn soil, but a competition between man and man for the opportunity of living.

It is in the cities where the influences which tend to the modernization and concentration of the characters of the species, the intensification of human powers and their adaptation to the various special conditions go on most rapidly. That this intensification is not necessarily progress either physically or morally is aside from our present purpose.

It is in the cities where those characters and qualities not directly useful in the struggle for existence are first lost or atrophied.

Conversely it is in the "backwoods," the region most distinct from human conflicts, where primitive customs, antiquated peculiarities, and useless traits are longest and most persistently retained. The life of the backwoods will be not less active and vigorous, but it will lack specialization.

It is not well to push this analogy too far, but we may perhaps find in it a suggestion as to the development of the eels. In every city there is a class which partakes in no degree of the general line of development. Its members are specialized in a wholly different way, thereby taking to themselves a field which the others have abandoned, and making up in low cunning what they lack in strength and intelligence.

Thus among the fishes we have in the regions of closest competition a degenerate and non-ichthyized form, lurking in holes among rocks and creeping in the sand, thieves and scavengers among fishes.

The eels fill a place which would otherwise be left unfilled. In their way, they are perfectly adapted to the lives they lead. A multiplicity of vertebral joints is useless to the typical fish, but to the eel strength and suppleness are everything, and no armature of fin or scale or bone so desirable as its power of escaping through the smallest opening.

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\* In 1894 a single haul of a net in a shallow bay on Key West brought in seventy-five species. A week's work about Martha's Vineyard yielded but forty-eight kinds.

It may be too that, as rovers in the open sea, the strong swift members of the mackerel family find a positive advantage in the possession of many vertebræ, and that to some adaptation to their mode of life we must attribute their lack of "ichthyization" of the skeleton. But this is wholly hypothetical, and we may leave the subject with the general conclusion that with the typical fish advance in structure has specialized the vertebræ, increased their size and the complexity of their appendages, while decreasing their number. That with some exceptions and modifications this reduction is characteristic of fishes in the tropics, and that it is so because in the tropics the processes of evolution are most active, so far as the fishes are concerned.

**REPORT UPON A COLLECTION OF FISHES MADE AT GUAYMAS,  
SONORA, MEXICO, WITH DESCRIPTIONS OF NEW SPECIES.**

BY

**BARTON W. EVERMANN AND OLIVER P. JENKINS.\***

(With Plates I-II.)

Through the liberality of the trustees of De Pauw University and of the Indiana State Normal school, the authors of this paper were enabled, during the summer of 1887, to make a collection of fishes in the Bay of Guaymas, Sonora, Mexico.

A preliminary account of the collection, with descriptions of seventeen species thought by us to be new, has been published in the Proceedings of the United States National Museum for 1888, pp. 137-158.

Many interruptions and other duties have prevented the preparation of a fuller account of the collection until the present time.

It is proper to refer here to the former studies of the fishes of the Gulf of California.

The first considerable collection of fishes from the Gulf of California was made by Mr. John Xantus, who was for some time stationed at Cape San Lucas as a tidal observer.

The fishes he obtained were sent to the Smithsonian Institution and were described by Dr. Theodore Gill in the Proceedings of the Academy of Natural Sciences of Philadelphia for the years 1862 and 1863. This collection was again studied by Professors Jordan and Gilbert, the results of which studies were published in the Proceedings of the U. S. National Museum for 1882. This collection, although comprising fewer than one hundred species, was a most valuable one, containing, as it did, a large proportion of new species and several new genera.

In 1873-'75, Dr. Thomas H. Streets, while on board the U. S. steamer *Narragansett*, engaged in making a survey of Lower California, made a collection of fishes in the Gulf of California, the account of which was published in Bulletin No. 7, U. S. National Museum, 1877.

In 1880-'81, Capt. Henry E. Nichols, during cruises of the U. S. Coast and Geodetic Survey steamer *Hassler* along the west coast of Mexico

\* The order in the signature of this paper indicates nothing as to seniority of authorship. The authors shared equally both in making the collection and in the preparation of the report, and are to be held equally responsible for its contents. This statement applies also to the paper by them describing seventeen new species of this collection which has already appeared.

and Central America, including the Gulf of California and the Bay of Guaymas, made various collections of fishes.

These have been studied by Professors Jordan and Gilbert (Proc. U. S. Nat. Mus. 1881, p. 225).

In 1880-'81, Prof. Charles H. Gilbert spent ten weeks collecting fishes at Mazatlan, a point which may be considered as being at the mouth of the Gulf of California. During this time he obtained a large and very important collection. This collection was made for the U. S. National Museum and served as the basis for many papers by Professors Jordan and Gilbert which have appeared in the Proceedings of the U. S. National Museum and in the Bulletins of the U. S. Fish Commission. The first of these papers announced that one hundred and seventy species were obtained and gave descriptions of thirty-three new species.

Mr. W. N. Lockington has at various times given accounts of fishes from the Gulf of California, some of which he described as new.

In the Proceedings of the U. S. National Museum 1882, p. 378, Professors Jordan and Gilbert give an account of a collection of fourteen species made by Mr. L. Belding near Cape San Lucas.

In the Proceedings of the U. S. National Museum 1884, Dr. Jordan published an account of a small collection of four species made by Mr. H. F. Emeric at Guaymas. One of these, *Gobiosoma histrio*, was described as new.

Besides these collections, there have been described at various times from points in or near the Gulf of California, a number of species by others, especially by Dr. Günther and by Dr. Steindachner, the latter having at one time visited the west coast of North America with Agassiz on the *Hassler* expedition.

Nearly all the species heretofore reported from the Gulf of California have been from points south of Guaymas.

Guaymas is situated on the Bay of Guaymas, Gulf of California, in latitude 28° north and longitude 34° west, a position on the west coast of Sonora, Mexico, about opposite the middle portion of the peninsula of Lower California.

The climate is very dry, there being at most but very few light showers at any time.

The bay is surrounded by mountains wholly of volcanic origin. The coast line is an almost unbroken wall of rough, sharp-outlined rock which the sea has in many places undermined into overhanging cliffs or caves. This wall, always high, sometimes rises into immense precipices.

There are but few places in the region of the bay where the seine could be used to any advantage, and these had to be prepared by removing many rocks.

We were fortunate enough in being able to secure the aid of a French fisherman, Mr. Theodore Canevet, who, being a man of intelligence, was able to render us great aid in many ways. He was well informed as to

the most favorable fishing places and possessed fair fishing appliances, and was really the only fisherman there who was at all well equipped for his work.

The water of the bay, at least near the city of Guaymas, is very warm.

Although Guaymas is a considerable city, containing about ten thousand inhabitants, there is no regular fish market. The reason for this does not lie in the scarcity of fishes in the bay, for great numbers of the best of food fishes abound.

The extremely warm climate renders the keeping of fish even for a short time a matter of great difficulty, and the high price of ice makes its use impracticable. Otherwise the Bay of Guaymas might be made to furnish an abundance of a choice article of food to the people along the line of the Sonora Railroad, a thing of which they certainly stand in great need.

During our visit in the month of July, the weather was so hot that fishing in the daytime was nearly impossible, and nearly all of our seining was done after night. This was of course a serious interference to certain kinds of collecting.

From information gained from the fishermen, we have no doubt that many species visit these coasts in the winter months which are absent, or at least are not found near shore, during the summer. *Oynoscion macdonaldi*, recently described by Dr. Gilbert, is an example; it is a very large fish common along the east coast of the gulf in winter, but never seen there in the summer months.

The collection contains one hundred and ten species, of which twenty-one appear to be new. Three species and three genera had not before been reported south of San Diego or Cerros Island; forty-six species had already been reported from this geographical region north of Mazatlan; forty-one species were not hitherto known from any point north of Mazatlan; while but twenty-four species of the collection are known from both the Atlantic and Pacific coasts of the Americas. Of the whole collection only eleven species are known from any point north of the Gulf of California, while the remaining species, with the exception of those described by us as new, are known, in the main, along the southern coasts of Mexico and Central America to South America.

In the "Shore Fishes of Central America" (published in 1869), Dr. Günther considered the evidence of the existence of a water way through the Isthmus of Panama at a comparatively recent period, as shown by the similarity of the fish faunæ of the two coasts. There were known to Dr. Günther at that time one hundred and ninety-three species of marine or brackish-water fishes, as found on the two coasts of Central America, fifty-nine of which he regarded as common to both coasts. This is 31 per cent. of the whole number, and he thought that further exploration would increase this percentage. He was thus led to conclude that there was, at no very remote period, a depression of the

Isthmus of Panama permitting the passage of fishes from one side to the other.

Subsequently, Dr. Günther, in his "Introduction to the Study of Fishes" (1880, p. 280), claimed a still larger proportion of the fishes of tropical America to be identical on the two sides of the continent. He concluded that "with scarcely any exceptions the genera are identical, and of the species found on the Pacific side nearly one-half have proved to be the same as those of the Atlantic. The explanation of this fact has been found in the existence of communications between the two oceans by channels and straits which must have been open till within a recent period. The isthmus of Central America was then partially submerged, and appeared as a chain of islands similar to that of the Antilles; but as the reef-building corals flourished chiefly north and east of those islands, and were absent south and west of them, reef fishes were excluded from the Pacific shores when the communications were destroyed by the upheaval of the land."

But of the fifty-nine species which Dr. Günther regarded as identical on the two shores, thirty are now regarded as specifically distinct by Dr. Jordan (Proc. U. S. Nat. Mus. 1885, 394), and this leaves but 15 per cent. of the one hundred and ninety-three as common to both coasts.

Of four hundred and seven species from the two coasts known to Dr. Jordan in 1885, he regarded but seventy-one species, or 17½ per cent., as specifically identical; and if to this be "added some eight hundred species known from the Caribbean Sea and adjacent shores, we have about 6 per cent. of the whole number known, as common to the two coasts."

Upon this evidence Dr. Jordan based his opinion that "fuller investigations will not increase the proportion of common species, and, if it does not, the two faunæ show no greater resemblances than the similarity of physical conditions on the two sides would lead us to expect."

The explorations since 1885 have resulted, (1) in an addition of about one hundred species to one or the other of the two faunæ; (2) in showing that at least two species that were regarded as identical on the two shores (*Citharichthys spilopterus* and *C. gilberti*) are probably distinct; and (3) in the addition of but two species to those common to both coasts (*Hæmulon steindachneri* J. & G. and *Sidera castanea* J. & G. of the west coast probably being identical with *H. schranki* and *Gymnothorax funebris* of the east coast).

All this reduces still further the percentage of common species.

Of the one hundred and ten species obtained by us, twenty-four, or less than 21 per cent., appear to be common to both coasts. Of these twenty-four species, at least sixteen, from their wide distribution, would need no hypothesis of a former water way through the isthmus to account for their presence on both sides. They are species fully able to arrive at the Pacific shores of the Americas from the warm seas west. It thus appears that not more than eight species, less than 8 per cent. of our

collection, all of which are marine species, require any such hypothesis to account for their occurrence on both coasts of America.

As already stated, our studies have resulted in the addition of but two species (*Hamulon schranki* and *Gymnothorax funebris*) to the list of those thought to be identical on the two coasts.

This gives us, then, thirteen hundred and seven species that should properly be taken into account when considering this question, not more than seventy-two of which, or 5.5 per cent., seem to be identical on the two coasts. This is very different from the figures given by Dr. Günther in his "Study of Fishes."

Now, if from these seventy-two species admitted to be common to both coasts, we subtract the sixteen species of wide distribution—so wide as to keep them from being a factor in this problem—we have left but fifty-six species common to the two coasts that bear very closely upon the water-way hypothesis. *This is less than 4.3 per cent. of the whole number.*

But the evidence obtained from a study of other marine life of that region points to the same conclusion.

In 1881, Dr. Paul Fischer discussed this same question in his *Manuel de Conchyliologie*, pp. 168, 169, in a section on the Molluscan Fauna of the Panamic Province, and reached the same general conclusions. He says: "Les naturalistes américains se sont beaucoup préoccupés des espèces de Panama qui paraissent identiques avec celles des Antilles, ou qui sont représentatives. P. Carpenter estime qu'il en existe 35. Dans la plupart des cas, l'identité absolue n'a pu être constatée et on a trouvé quelques caractères distinctifs, ce qui n'a rien d'étonnant, puisque dans l'hypothèse d'une origine commune, les deux races pacifique et atlantique sont séparées depuis la période Miocène. Voici une liste de ces espèces représentatives ou identiques." Here follows a list of twenty species. "Mais ces formes semblables," he says, "constituent une infime minorité (3 per cent.)."

These facts have a very important bearing upon certain geological questions, particularly upon that one concerning the cause of the cold of the Glacial Period.

In Dr. G. Frederick Wright's recent book, "The Ice Age in North America," eight different theories as to the cause of the cold are discussed. The particular theory which seems to him quite reasonable is that one which attributes the cold as due to a change in elevation of different parts of the country, and a depression of the Isthmus of Panama is one of the most important changes that he considers. He says (p. 409): "Should a portion of the Gulf Stream be driven through a depression across the Isthmus of Panama into the Pacific, and an equal portion be diverted from the Atlantic coast of the United States by an elevation of the sea-bottom between Florida and Cuba, the consequences would necessarily be incalculably great, so that the mere existence of such a possible cause for great changes in the distribution



of moisture over the northern hemisphere is sufficient to make one hesitate before committing himself unreservedly to any other theory; at any rate, to one which has not for itself independent and adequate proof."

In the Appendix to the same volume, Mr. Warren Upham, in discussing the probable causes of glaciation, says: "The Quaternary uplifts of the Andes and Rocky Mountains and of the West Indies make it nearly certain that the Isthmus of Panama has been similarly elevated during the recent epoch. \* \* \* It may be true, therefore, that the submergence of this isthmus was one of the causes of the Glacial period, the continuation of the equatorial oceanic current westward into the Pacific having greatly diminished or wholly diverted the Gulf Stream, which carries warmth from the tropics to the northern Atlantic and northwestern Europe."

Any *very* recent means by which the fishes could have passed readily from one side to the other would have resulted in making the fish fauna of the two shores practically identical; but the time that has elapsed since such a water way could have existed has been long enough to allow the fishes of the two sides to become *practically distinct*. That the molluscs of the two shores are also almost wholly distinct, as shown by Dr. Fischer, is even stronger evidence of the remoteness of the time when the means of communication between the two oceans could have existed, for "species" among molluscs are probably more persistent than among fishes.

Our present knowledge, therefore, of the fishes of tropical America justifies us in regarding the fish fauna of the two coasts as being essentially distinct, and that there has not been, at any comparatively recent time, any water way through the Isthmus of Panama.

We are under great obligations to the Mexican minister at Washington, Señor Romero, and to other officials of the Mexican Government, for valuable assistance and for many courtesies extended to us; also to Hon. A. Willard, United States consul at Guaymas, who rendered us valuable aid in many ways; and to Dr. David S. Jordan, president of Indiana University, we wish to acknowledge our great indebtedness for the use of his valuable library and extensive collections.

The following is a list of the twenty-one species described as new to science:

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| 1. <i>Rhinoptera steindachneri</i> .         | 12. <i>Gobius chiquita</i> .              |
| 2. <i>Synodus jenkinsi</i> Jordan & Bollman. | 13. <i>Gobius longicaudus</i> .           |
| 3. <i>Siphostoma arcum</i> .                 | 14. <i>Gillichthys y-canda</i> .          |
| 4. <i>Menidia clara</i> .                    | 15. <i>Gillichthys guaymasi</i> .         |
| 5. <i>Menidia sardina</i> .                  | 16. <i>Scorpaena sonora</i> .             |
| 6. <i>Atherinops regis</i> .                 | 17. <i>Gnathypops scopis</i> .            |
| 7. <i>Centropomus grandoculatus</i> .        | 18. <i>Opisthognathus ommata</i> .        |
| 8. <i>Mycteroperca jordani</i> .             | 19. <i>Auchenopterus asper</i> .          |
| 9. <i>Hermosilla azurea</i> .                | 20. <i>Pseudonoblennius hypacanthus</i> . |
| 10. <i>Upeneus rathbuni</i> .                | 21. <i>Citharichthys gilberti</i> .       |
| 11. <i>Pseudojulis venustus</i> .            |   |

One of these species, *Gillichthys y-cauda*, has since been reported from San Diego by Dr. Gilbert, in the Proceedings of the U. S. National Museum, vol. XII, 363; while another species, *Synodus jenkinsi*, has been obtained off the coast of Colombia, from which specimens it was described by Dr. Jordan and Mr. Bollman in the Proceedings of the U. S. National Museum for 1889, p. 153.

The following genera and species have not been reported before from any point south of San Diego, California, or Cerros Island:

1. *Hemiramphus rosæ*. (San Diego Bay.)
2. *Xenistius californiensis*. (San Diego; Cerros Island.)
3. *Iæsthes gilberti*. (Santa Barbara and San Diego, California.)

The following forty-six species have already been recorded from the faunal area embracing the Gulf of California north of Mazatlan:

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|--|--------------------------------------|
| 1. <i>Sphyrna zyæna</i> .                | 24. <i>Pomadasis axillaris</i> .     |
| 2. <i>Rhinobatus glaucostigma</i> .      | 25. <i>Hæmulon maculicauda</i> .     |
| 3. <i>Albula vulpes</i> .                | 26. <i>Hæmulon flaviguttatum</i> .   |
| 4. <i>Elops saurus</i> .                 | 27. <i>Hæmulon schranki</i> .        |
| 5. <i>Stolephorus opercularis</i> .      | 28. <i>Hæmulon sexfasciatum</i> .    |
| 6. <i>Hemiramphus ninfasciatus</i> .     | 29. <i>Calamus brachysomus</i> .     |
| 7. <i>Hippocampus ingens</i> .           | 30. <i>Girella nigricans</i> .       |
| 8. <i>Fistularia depressa</i> .          | 31. <i>Kyphosus analogus</i> .       |
| 9. <i>Mugil cephalus</i> .               | 32. <i>Upeneus dentatus</i> .        |
| 10. <i>Mugil curema</i> .                | 33. <i>Umbrius xanti</i> .           |
| 11. <i>Sphyræna argentea</i> .           | 34. <i>Cynoscion parvipinnis</i> .   |
| 12. <i>Polydactylus approximans</i> .    | 35. <i>Gerres gracilis</i> .         |
| 13. <i>Scomber colias</i> .              | 36. <i>Harpe diplotænia</i> .        |
| 14. <i>Tracharops crumenophthalmus</i> . | 37. <i>Glyphisodon saxatilis</i> .   |
| 15. <i>Caranx caballus</i> .             | 38. <i>Chaetodipterus zonatus</i> .  |
| 16. <i>Selene vomer</i> .                | 39. <i>Gobius sagittula</i> .        |
| 17. <i>Trachynotus fasciatus</i> .       | 40. <i>Gillichthys mirabilis</i> .   |
| 18. <i>Nematistius pectoralis</i> .      | 41. <i>Gobiosoma histrio</i> .       |
| 19. <i>Diplectrum radiale</i> .          | 42. <i>Porichthys margaritatus</i> . |
| 20. <i>Serranus maculato-fasciatus</i> . | 43. <i>Labrosomus xanti</i> .        |
| 21. <i>Hoplopagrus gûntheri</i> .        | 44. <i>Paralichthys adpersus</i> .   |
| 22. <i>Lutjanus novemfasciatus</i> .     | 45. <i>Balistes polylepis</i> .      |
| 23. <i>Orthopristis inornatus</i> .      | 46. <i>Spheroides politus</i> .      |

The following forty-one species have not hitherto been reported from any point north of Mazatlan:

1. *Galens lunulatus*. Mazatlan.
2. *Galens dorsalis*. Mazatlan; Panama.
3. *Eulamia fronto*. Mazatlan.
4. *Scoriodon longurio*. Mazatlan; Panama.
5. *Sphyrna tudes*. Mazatlan.
6. *Urolophus nebulosus*. Colima.
7. *Dasyatis longus*. Mazatlan; Acapulco; Panama.
8. *Tachysurus platypogon*. Mazatlan and southward.
9. *Chanos chanos*. Mazatlan; Chiapas.
10. *Opisthonema libertatis*. Mazatlan; Libertad; Panama.
11. *Stolephorus macrolepidotus*. Mazatlan and southward.
12. *Synodus jenkinsi*. Off the coast of Colombia.
13. *Gymnothorax funebris*. Mazatlan.

14. *Tylosurus stoltzmanni*. Mazatlan; Panama.
15. *Scomberomorus maculatus*.
16. *Caranx latus*. Mazatlan; Panama.
17. *Caranx hippos*. Mazatlan; Panama.
18. *Caranx speciosus*. Mazatlan; Panama.
19. *Chloroscombrus orqueta*. Mazatlan; Panama.
20. *Oligoplites altus*. Mazatlan; Panama.
21. *Oligoplites saurus*. Mazatlan; Panama.
22. *Centropomus undecimalis*. Mazatlan; Panama.
23. *Promicrops guttatus*. Mazatlan; Panama.
24. *Epinephelus analogus*. Mazatlan; Acapulco; La Union; Panama.
25. *Lobotes surinamensis*. Punta Arenas; Panama.
26. *Lutjanus argentiventris*. Mazatlan; Panama.
27. *Lutjanus guttatus*. Mazatlan; Panama.
28. *Lutjanus colorado*. Mazatlan; Panama.
29. *Orthopristis chalcus*. Mazatlan; Panama.
30. *Pomadasis elongatus*. Mazatlan and southward.
31. *Pomadasis macracanthus*. Mazatlan; Punta Arenas; Chiapam; Panama.
32. *Kyphosus elegans*. Mazatlan.
33. *Upeneus grandisquamis*. Mazatlan; Panama.
34. *Bairdiella icistia*. Mazatlan.
35. *Micropogon ectenes*. Mazatlan.
36. *Gerres lineatus*. Mazatlan; Acapulco; San Blas; Chiapam.
37. *Chætodon humeralis*. Mazatlan; Colima; Panama; Sandwich Islands!
38. *Pomacanthus zonipectus*. Mazatlan; San Salvador; Panama.
39. *Scorpena plumieri*. Mazatlan; Panama.
40. *Isesthes striatus*. Panama.
41. *Achirus mazatlanus*. Mazatlan.

The following twenty-four species are now known from both the Atlantic and Pacific coasts of North America:

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|--|--------------------------------------|
| 1. <i>Sphyrna tudes</i> .                | 13. <i>Caranx hippos</i> .           |
| 2. <i>Sphyrna zygaena</i> .              | 14. <i>Selene vomer</i> .            |
| 3. <i>Albula vulpes</i> .                | 15. <i>Oligoplites saurus</i> .      |
| 4. <i>Elops saurus</i> .                 | 16. <i>Centropomus undecimalis</i> . |
| 5. <i>Hemiramphus unifasciatus</i> .     | 17. <i>Diplectrum radiale</i> .      |
| 6. <i>Mugil cephalus</i> .               | 18. <i>Promicrops guttatus</i> .     |
| 7. <i>Mugil curema</i> .                 | 19. <i>Lobotes surinamensis</i> .    |
| 8. <i>Scomber colias</i> .               | 20. <i>Hæmulon schranki</i> .        |
| 9. <i>Scomberomorus maculatus</i> .      | 21. <i>Gerres gracilis</i> .         |
| 10. <i>Trachurops crumenophthalmus</i> . | 22. <i>Glyphisodon saxatilis</i> .   |
| 11. <i>Caranx caballus</i> .             | 23. <i>Scorpena plumieri</i> .       |
| 12. <i>Caranx latus</i> .                | 24. <i>Gymnothorax funebris</i> .    |

#### 1. *Galeus lunulatus* (Jordan & Gilbert).

*Mustelus lunulatus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 108. (*Mazatlan*).  
 Jordan and Gilbert, Bull. U. S. Fish Comm. 1882, 105. (Name only. *Mazatlan*).  
*Galeus lunulatus* Jordan, Proc. U. S. Nat. Mus. 1885, 363. (Name only). Jordan,  
 Cat. Fishes N. A., 1885, 6.

We obtained but one specimen of this shark, 20 inches in length. It does not appear to be at all frequent in the bay, as it was not known to the local fishermen.

2. *Galeus dorsalis* (Gill).

*Mastelus dorsalis* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 149. (*Panama*). Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 109. (*Panama*).

*Galeus dorsalis*, Jordan, Proc. U. S. Nat. Mus. 1885, 363. (Name only).

A half dozen fœtuses of this species were sent to us by Mr. Theodore Cauevet after we had left Guaymas.

Measurements of two specimens (Nos. 190, a ♂, and 191, a ♀) give the following results:

	190, ♂	191, ♀
	mm.	mm.
Total length .....	182	184
Distance from snout to origin of first dorsal .....	58	60
Distance between dorsals .....	35	38
Length of first dorsal .....	17	18
Height of first dorsal .....	21	18
Length of pectoral .....	19	21
Length of second dorsal .....	16	13
Height of second dorsal .....	13	14
Length of snout .....	16	17
Tip of snout to mouth .....	16	14
Tip of snout to nostril .....	11	11
Distance between nostrils .....	5	.....
Width of mouth .....	11	10
Interorbital space .....	11	10
Greatest width of head .....	20	19
Depth of head .....	8	9
Length of ventral fin .....	12	10
Length of claspers (free part) .....	6	.....
Diameter of eye .....	8	7

The head is relatively quite broad but flattened vertically, the snout rather long and tapering, while the body is long and very slender, tapering gradually to the tail. The shagreen is more or less developed over the entire body but is most pronounced on the head and along the median dorsal line; it is also well developed upon the pectoral fins but less so on the others.

3. *Eulamia fronto* (Jordan & Gilbert).*Tiburón.*

*Carcharias fronto* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 102. (*Mazatlan.*); Bull. U. S. Fish Comm. 1882, 105. (Name only. *Mazatlan.*)

*Carcharhinus fronto*, Jordan, Proc. U. S. Nat. Mus. 1885, 363. (Name only.) *Ibid.*, Cat. Fishes N. A., 1885, 7.

One specimen, 28 inches long, was taken by us. This shark is very common in the Bay of Guaymas, where large specimens are frequently taken with the hook. It often seriously interferes with hook and line fishing by stealing the catch before it can be gotten out of the water by the fisherman.

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4. *Scoliodon longurio* Jordan & Gilbert.*Tiburón.**Carcharias longurio* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 106. (*Mazatlan.*)*Scoliodon longurio*, Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 105. (*Mazatlan.*  
Name only.)*Carcharkinus longurio*, Jordan, Proc. U. S. Nat. Mus. 1885, 363. (Name only.)  
Jordan, Cat. Fishes N. A., 1885, 8.

Two specimens, 17 and 18 inches long respectively, were taken.

5. *Rhinoptera steindachneri* sp. nov.

(Type No. 43235, U. S. N. M.)

*Gabilan.*

(Plate I.)

Width of disk 1.8 times its length; anterior border nearly straight from spiracle for about two-thirds its length; thence to the tip slightly convex, thus giving the fin the outline of a wing; posterior border strongly concave in its outer half, nearly straight along its inner half. Length of anterior margin of pectoral not quite equal to the length of the disk, but about equal to that of the posterior border; inner border of pectoral more than half interorbital space; greatest width of ventral fins equals half the interorbital width, while its length is nine-tenths of the same.

Tail very slender, its length greater than that of the disk ( $1\frac{1}{2}$  times length of disk in one specimen, while in the other it but slightly exceeds the disk).

Muzzle emarginate; interorbital space concave, its width equal to the distance between the spiracles, or the greatest depth of the body. The cephalic fin is a little broader than the head, and the length of the free portion is contained more than twice in the interorbital width.

Height of the dorsal fin  $1\frac{1}{2}$  times its length. In one specimen there are two stout, strongly serrated spines near the base of the tail, these lying very close together, while in the other specimen there is but one spine; these spines are about equal in size, the length of the free portion being about  $2\frac{1}{2}$  times that of eye.

Skin everywhere smooth.

Nasal valves confluent into a broad flap with a free margin which, together with the upper side, is covered with papillæ.

Teeth in the lower jaw in seven series; seven teeth developed in the median, and six in each of the other, series. The teeth of the median series are hexagonal in shape, the length being three-elevenths of the breadth, which is nearly twice the breadth of a tooth of the second series; the teeth of the second series hexagonal, the length being seven-twelfths of the width, which is again nearly twice the width of those of the next series; in the next series the teeth are diamond-shaped, the length  $1\frac{1}{2}$  times the breadth; those of the last (outer) series triangular, the length being about twice the breadth.

The teeth of the upper jaw very similar to those of the lower.

*Color:* Above, uniform dark brown all over, a little paler on head; below, creamy white, except outer third of pectorals, which are darker.

This very interesting species was frequently seen by us at various places in the bay of Guaymas. It has the habit of jumping some distance out of the water at irregular intervals, and at such times presents a very striking appearance.

None of the teeth are worn, except those of the first three transverse series.

It is known to the local fishermen as the *Gabilan*.

Two specimens were obtained by us, the measurements of which we here give in millimetres:

Numbers on specimens .....	64	65
Length of disk to origin of dorsal fin .....	390	386
Width of disk .....	710	700
Length of tail .....	410	520
Length of ventral fins .....	80	90
Greatest width of ventral fins .....	50	55
Greatest depth of body .....	95	93
Depth of head measured over the jaws .....	65	71
Width of interorbital space .....	98	107
Width between spiracles .....	98	107
Length of anterior margin of pectoral .....	320	347
Length of posterior margin of pectoral .....	360	360
Length of inner margin of pectoral .....	55	55
Length of free portion of caudal -pine .....	34	32
Longitudinal diameter of spiracle .....	27	25
Vertical diameter of spiracle .....	20	20
Diameter of eye .....	14	13
Distance from eye to spiracle .....	20	25
Length of free portion of cephalic fin .....		45
Depth of notch in cephalic fin .....	18	18
Width of mouth .....	60	60
Distance of mouth from notch in cephalic fin .....	70	65
Distance from mouth to vent .....		290

We take great pleasure in naming this interesting species for Dr. Franz Steindachner of Vienna, in recognition of his valuable services to American ichthyology.

#### 6. *Sphyrna tudes* (Cuvier).

*Zygæna tudes* Cuvier, Règne Animal. Günther, Cat. Fishes, VIII, 382, 1870.

*Sphyrna tudes*, Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 105. (Name only; *Mazatlan*). Jordan, Proc. U. S. Nat. Mus. 1885, 364. (Name only.) Jordan, Cat. Fishes N. A., 1885, 9.

The collection contains but one specimen of this species twenty inches in length.

#### 7. *Sphyrna zygaena* (L.).

*Squalus zygaena* Linnæus, Systema Naturæ, 1758, x, 399.

*Sphyrna zygaena*, Jordan, Proc. U. S. Nat. Mus. 1885, 364 (*Mazatlan*; *Panama*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 32 (*San Diego, California*).

One specimen 2½ feet long.

8. *Rhinobatus glaucostigma* Jordan & Gilbert.

*Rhinobatus glaucostigma* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1883, 210 (*Mazatlan*); Jordan, Proc. U. S. Nat. Mus. 1885, 364 (name only); Jordan, Cat. Fishes N. A., 1885, 10.

*Rhinobatus productus*, Streets, Bull. U. S. Nat. Mus. 1877, VII, 55 (*San Bartholome Bay, Lower California*).

*Rhinobatus leucorhynchus*, Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 105 (name only. *Mazatlan*).

One specimen 20 inches long.

9. *Urolophus nebulosus* Garman.

*Raya*.

*Urolophus nebulosus* Garman, Proc. U. S. Nat. Mus. 1885, 41 (*Colima, Mexico*).

This species, represented in the collection by eighteen specimens, scarcely differs from *Urolophus halleri* Cooper, except that the upper parts are light brown with small scattered inkish spots. These spots are most evident in the foetuses in which they are placed regularly in a row around the pectorals, this regularity disappearing with age. In the younger foetuses the skin of the upper margin of the spiracles is prolonged in a lanceolate flap as long as the eye; this character disappears at an early age.

Of the eighteen specimens secured by us fourteen were foetuses, seven each from numbers 1 and 2 of the following table:

	1	2	3	4
	mm.	mm.	mm.	mm.
Length of disk.....	215	190	190	200
Width of disk.....	200	243	185	195
Length of tail from base of ventrals.....	133	138	133	133

Three foetuses give the following measurements:

	1	2	3
Length of disk.....	73	85	57
Width of disk.....	79	89	54
Length of tail.....	60	66	59
Interorbital space.....	10	12	9
Snout to eye.....	20	22	12

10. *Dasyatis longus* Garman.

*Raya*.

*Dasidatis longa* Garman, Bull. Mus. Comp. Zool. 1880, VI, 170 (*Acapulco; Panama*); Jordan & Gilbert, Synopsis, 1882, 66.

*Dasybatis longus*, Jordan, Proc. U. S. Nat. Mus. 1885, 364 (*Mazatlan*).

Four specimens of this species, and a pair of jaws of another specimen too large to preserve, are in the collection. The measurements are as follows:

	1	2	3	4
	Inches.	Inches.	Inches.	Inches.
Length of disk.....	11.25	8.25	7.50	7.75
Width of disk.....	12.00	9.00	8.25	8.25
Length of tail.....	12 +	12.00	11.00	11.00

In specimen No. 1 the tail is broken off, but it was probably not much over 12 inches in length. Mr. Garman, in his description, makes the tail of this species more than twice the length of the disk, which is far from the case in our specimens.

Our specimens indicate that the asperities on the younger specimens appear earlier on the back than on the shoulder girdles.

This record extends the range of this species north from Mazatlan.

#### 11. *Tachysurus platypogon* Günther.

*Bagre.*

*Arius platypogon* Günther, Cat. Fishes Brit. Mus. v, 147, 1864. (*San José, Guatemala*); Steindachner, Ichthyol. Beiträge iv, 17, 1875; Jordan, Bull. U. S. Fish Comm. 1892, 44 (*Mazatlan*; *Libertad*; *Punta Arenas*; *Panama*).

Six specimens were obtained, the largest having a total length of 17 inches.

A good description is given by each of the naturalists referred to in the above synonymy.

#### 12. *Albula vulpes* L.

*Sabalo.*

*Albula vulpes*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 457 (*Monterey Bay*; *San Diego*); *ibid.*, 1881, 37 and 278 (*San Diego Bay*; *Pequina Bay, Lower Calif.*); *ibid.*, 1882, 622 (*Panama*).

Numerous specimens of this common and widely distributed fish were obtained. It is one of the most common species here.

#### 13. *Elops saurus* L.

*Sabalo.*

*Elops saurus* Linnæus, Syst. Naturæ; Günther, Cat. Fishes, 1868, vii, 470.

*Elops saurus*, Jordan & Gilbert, Bull. U. S. Fish Comm. 1892, 105 and 109 (*Mazatlan*; *Panama*); *ibid.*, Proc. U. S. Nat. Mus. 1892, 353 and 622 (*Cape San Lucas*; *Panama*); *ibid.*, 1895, 368 (*Mazatlan*; *Panama*); Jordan, Cat. Fishes, 1895, 34.

This, like the preceding, is a common fish at Guaymas, and is known by the same name, *Sabalo*, to the local fishermen. Of a half-dozen specimens brought home by us, the longest measures 17 inches in total length.

#### 14. *Chanos chanos* (Forskäl).

*Sabalo.*

*Mugil chanos* Forskäl, Descr. Anim., 74; *Chanos chanos*, Jordan, Proc. U. S. Nat. Mus. 1895, 368 (*Mazatlan*).

Six individuals of this East Indian species were obtained. It appears to be common at Guaymas.



15. *Opisthonema libertatis* (Günther).*Sardina*.*Meletta libertatis* Günther, Proc. Zool. Soc. London 1866, 603 (*Libertad*).*Clupea libertatis* Günther, Cat. Fishes, 1868, VII, 433.*Opisthonema libertate*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 622 (*Panama*); Jordan, Proc. U. S. Nat. Mus. 1885, 366 (*Mazatlan*; *Panama*).

This species is very abundant at Guaymas, many specimens being obtained, the largest measuring  $8\frac{1}{2}$  inches in total length.

The general color is the same as in *O. oglinum*, the humeral spot is very plain. This species is, however, more elongate, the depth being contained 3 times in the length; the head is larger and less deep, and is contained  $3\frac{1}{2}$  instead of  $4\frac{1}{2}$  in length.

16. *Stolephorus macrolepidotus* (Kner & Steind.).*Sardina bocona*.*Engraulis macrolepidotus* Kner & Steindachner, Abhandl. Bayer. Akad. Wiss., x, 1864, 21, Pl. III, Fig. 2 (*Rio Bayano*; *Panama*); Günther, Cat. Fishes, 1868, VII, 385.*Stolephorus macrolepidotus*, Jordan, Cat. Fishes, 1885, 37; *ibid.*, Proc. U. S. Nat. Mus. 1885, 367 (*Mazatlan*; *Panama*).

Very abundant. Great numbers of this species, together with many of *Opisthonema libertatis*, died in the summer of 1887, and their dead and decaying bodies, washed up along the shore, rendered a summer residence at Guaymas almost unendurable.

17. *Stolephorus opercularis* Jordan & Gilbert.*Stolephorus opercularis* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 275 (*Punta San Felipe, Gulf of California*); Jordan, Cat. Fishes, 1885, 37; Jordan, Proc. U. S. Nat. Mus. 1885, 367 (*Gulf of California*).

Less common. Scales 39; anal rays 24; depth  $3\frac{1}{2}$ . Body more elongate than in *S. macrolepidotus*, the head much longer, bones less obliquely placed—this greater length showing itself in the greater length of the opercles and the greater basal width of the triangle of the cheeks. Body much less compressed and shorter.

18. *Synodus Jenkinsi* Jordan & Bollman.*Synodus jenkinsi* Jordan & Bollman, Proc. U. S. Nat. Mus. 1889, 153 (*Off coast of Colombia*).

Of this recently described species we obtained two specimens, 72 and 260 millimetres in length respectively.

19. *Gymnothorax funebris* (Ranzani).*Sidera castanea* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 647 (*Mazatlan*); *ibid.*, 1883, 210; Jordan, Cat. Fishes North Am., 1885, 51; Jordan, Proc. U. S. Nat. Mus. 1885, 369 (*Mazatlan*).

Three specimens, the largest 38 inches long. The dorsal is very faintly edged with black.

We are informed by Dr. Jordan that *Sidera castanea* can not be distinguished from the common *Gymnothorax funebris* of the West Indian fauna.

#### 20. *Tylosurus Stoltzmanni* (Steind.).

*Belone stoltzmanni* Steindachner, Ichthyol. Beiträge VII, 1878, 21.

*Tylosurus sierrita* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1891, 458 (*Mazatlan*).

*Tylosurus stoltzmanni*, Jordan, Cat. Fishes N. A., 1885, 59; Jordan, Proc. U. S. Nat. Mus. 1885, 370 (*Mazatlan*; *Panama*).

One specimen 28 inches long.

#### 21. *Hemiramphus unifasciatus* Ranzani.

*Hemiramphus unifasciatus* Ranzani, Comm. Inst. Bon., 1842, v, 326, Tab. 25; Jordan & Gilbert, Synopsis, 1882, 376; *ibid.*, Proc. U. S. Nat. Mus. 1882, 356 (*Cape San Lucas*); Jordan, Cat. Fishes N. A., 1885, 60.

Apparently not common, but one specimen having been obtained. Valued here as a food fish.

#### 22. *Hemiramphus rosæ* Jordan & Gilbert.

*Hemiramphus rosæ* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 335 (*San Diego Bay*). Jordan & Gilbert, Synopsis, 1882, 376. Jordan, Cat. Fish. N. A., 1885, 60.

Very common in the bay at Guaymas. The largest individual obtained measures 136 millimetres in total length, and 111 millimetres without the beak.

#### 23. *Siphostoma arcum* Jenkins & Evermann.

*Siphostoma arcum* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 137 (*Guaymas*).

But one specimen 9 centimetres long was obtained.

#### 24. *Hippocampus ingens* Girard.

*Hippocampus ingens* Girard, U. S. Pacific R. R. Survey, Fishes, 1858, 342 (*San Diego Bay*). Jordan & Gilbert, Synopsis Fish. N. A., 1882, 386. Jordan, Cat. Fish. N. A., 1885, 62.

Four specimens were obtained. Apparently it is quite rare, as even small specimens bring high prices as *curios*.

#### 25. *Fistularia depressa* Günther.

*Agujon*.

*Fistularia depressa* Günther, Shore Fishes, Challenger Exp., 1890, 69, Pl. XXXII, fig. D (*Lower California*). Jordan & Gilbert, Bull. U. S. Fish. Comm. 1882, 106 (name only) (*Mazatlan*). *Ibid.*, 109 (name only) (*Panama*). Jordan, Proc. U. S. Nat. Mus. 1885, 371 (*Mazatlan*). Jordan, Cat. Fish. N. A., 1885, 63 (name only).

Represented in the collection by five specimens, each from 25 to 30 inches in length. One specimen measures as follows:

	Millimeters.
Total length .....	735
Length to base of caudal .....	635
Length of caudal filament .....	102
Snout to origin of dorsal .....	521
Snout to origin of anal .....	514
Snout to origin of pectorals .....	235

	Millimeter.
Snout to origin of ventrals .....	316
Depth of body at dorsal .....	13
Width of body at dorsal .....	18
Width of interorbital space .....	10
Length of cleft of mouth .....	13

Head in length,  $2\frac{7}{8}$ ; eye in snout, 8; eye in head, 11.

In some specimens the two principal ridges diverge toward the end of the snout and then again converge as described by Günther in the Shore Fishes of the Challenger Expedition.

## 26. *Mugil cephalus* L.

*Liza*.

To the synonymy of this species given by Jordan and Swain in the Proc. U. S. Nat. Mus. 1884, 263, the following may now be added :

*Mugil cephalus*, Jordan, Cat. Fishes N. A., 1885, 64; Jordan, Proc. U. S. Nat. Mus. 1885, 371.

Rather common, but only small specimens were obtained.

## 27. *Mugil curema* Cuv. & Val.

*Liza*.

To the synonymy of this species given by Jordan and Swain in Proc. U. S. Nat. Mus. 1884, 268, may be added :

*Mugil curema*, Jordan, Proc. Nat. Mus. 1885, 371 (*Mazatlan*; *Panama*). Jordan, Cat. Fish N. A., 1885, 64.

*Mugil brasiliensis* of most authors, but not of Agassiz, nor of Jordan and Swain.

This is a very common fish in the Bay of Guaymas, and is highly prized as food.

## 28. *Menidia clara* sp. nov.

(Type, No. 43237, U. S. N. M.)

Head,  $4\frac{1}{8}$  ( $4\frac{1}{8}$ ); depth,  $6\frac{3}{10}$  ( $7\frac{1}{8}$ ); eye, 3; D. V, 1-9; A. 25; scales 56, 11 in transverse series.

Body slender, general form that of *M. sardina*; eye large, equals width of interorbital space; distance between dorsal fins less than that from tip of snout to posterior rim of orbit. Origin of first dorsal nearer tip of caudal than snout; pectorals three-fourths length of head. Scales small and persistent.

General color that of *M. sardina*, the lateral band plumbeous above and silvery below.

Allied to *M. sardina* Jenkins and Evermann, from which it may be readily distinguished by the greater number of scales in longitudinal series.

One specimen, 72 millimetres long.

## 29. *Menidia sardina* Jenkins & Evermann.

*Peje Reje* of the fishermen.

*Atherina sardina* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 137 (*Guaymas*).

Known from three specimens (No. 39633, U. S. National Museum).

30. *Atherinops regis* Jenkins & Evermann.*Pez del Rey.**Atherinops regis* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 138 (*Guaymas*).

A common species.

31. *Sphyræna argentea* Girard.*Agujon.**Sphyræna argentea* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 144. Girard, Pac. R. R. Survey, Zool., Fishes, 39, Pl. 14, 1859.*Sphyræna lucasana* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 86.*Sphyræna argentea*, Steindachner, Ichthy. Beitr. VII, 1, 1878. Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 456 (*San Francisco; Santa Barbara Islands; Monterey*). Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 44 (*San Francisco; Monterey; Santa Barbara*). Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 358 (*Cape San Lucas*). Rosa Smith, Proc. U. S. Nat. Mus. 1883, 234 (*Todos Santos Bay, Lower California*). Jordan, Proc. U. S. Nat. Mus. 1885, 372 (name only). Jordan, Cat. Fishes N. A., 65, 1885.

Five specimens were taken. It is fairly abundant and is in much esteem as a food fish.

32. *Polydactylus approximans* Lay & Bennett.*Raton.**Polynemus approximans* Lay & Bennett, Beechey's Voyage to the Pacific, Zoölogy, 57.*Trichidion approximans*, Gill, Proc. Acad. Nat. Sci. Phila. 1862, 258.*Polynemus approximans*, Günther, Fishes Central America, 1869, 423. Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 365 (*Cape San Lucas*). Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 376 (*Panama*). Jordan, Proc. U. S. Nat. Mus. 1885, 372 (*Mazatlan; Panama*). Jordan, Cat. Fishes N. A., 1885, 66.

Six specimens were obtained.

33. *Scomber colias* Gmelin.Apparently not common, as but two specimens were secured. Head,  $7\frac{3}{4}$  (8); depth,  $11\frac{1}{2}$  (12); eye in head,  $4\frac{1}{4}$ ; eye in snout,  $1\frac{1}{2}$ .34. *Scomberomorus maculatus* (Mitchill).*Pez Sierra.*

The Spanish mackerel is common at Guaymas, and there, as elsewhere, is an important food fish.

35. *Trachurops crumenophthalmus* (Bloch).*Mejara.**Trachurops brachychirus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 261 (*Cape San Lucas*). *Caranx crumenophthalmus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 358. (Two specimens from Cape San Lucas, types of *Trachurops brachychirus* Gill.)Two specimens, one of which measures 300 millimetres in total length, 245 millimetres to base of caudal, 265 millimetres to end of middle caudal rays; head,  $3\frac{1}{2}$  (4); depth,  $3\frac{1}{2}$  ( $4\frac{1}{2}$ ); eye in head,  $4\frac{3}{4}$ , in snout,  $1\frac{1}{2}$ .

36. *Caranx caballus* Günther.

*Caranx caballus* Günther, Trans. Zool. Soc. London 1869, 431. Jordan, Proc. U. S. Nat. Mus. 1885, 374 (*Mazatlan*; *Panama*).

Scutes about 37. This species is difficult to distinguish from *C. chrysos* (Mitchill), of which it would perhaps better be regarded as a variety.

A full description is given by Jordan and Gilbert in the "Synopsis," and full synonymy may be found in Proc. U. S. National Museum for 1883, 199.

37. *Caranx latus* Agassiz.

*Caranx latus* Agassiz, Pisc. Bras., 1829, 105.

*Caranx hippos*, Günther, II, 449, 1860.

For full synonymy of this species, see Jordan and Gilbert, Proc. U. S. National Museum 1883, 200.

One specimen was preserved. The species is quite common and is an important food fish.

38. *Caranx hippos* (Linnaeus).

*Curel.*

For full synonymy of this and the following species, see Jordan and Gilbert, Proc. U. S. National Museum 1883, 200-201.

A common fish. Four specimens were taken.

39. *Caranx speciosus* (Forskål).

*Palometa.*

Four specimens were obtained of this rather common fish.

40. *Selene vomer* (L.).

This is a very common fish at Guaymas. Measurements of seventeen individuals are given in the following table:

Specimen.	Distance from snout to dorsal curvature.	Total length.	Length to base of caudal.	Greatest depth.	Head in length.	Eye in snout.	Specimen.	Distance from snout to dorsal curvature.	Total length.	Length to base of caudal.	Greatest depth.	Head in length.	Eye in snout.
1	73	188	137	92	21	34	10	58	138	113	73	21	3
2	53	128	103	70	22	34	11	58	140	116	76	22	3
3	53	124	100	73	22	34	12	60	135	113	76	22	3
4	53	134	106	73	22	34	13	51	128	103	66	22	3
5	58	134	109	73	22	34	14	53	140	118	73	22	3
6	60	140	122	76	22	34	15	58	140	107	73	22	3
7	60	140	119	76	22	34	16	64	153	122	83	22	3
8	58	139	115	76	22	34	17	64	81	73	51	22	3
9	51	131	100	66	21	3							

41. *Chloroscombrus orqueta* Jordan & Gilbert.*Curel de Castilla.**Chloroscombrus orqueta* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1892, 646 (*Panama*).*Chloroscombrus ochrysurus* Jordan, Proc. U. S. Nat. Mus. 1885, 375 (*Panama*).

One specimen was obtained, which gave the following measurements:

	Millimetres.	In length to base of caudal.	In head.
Length to base of caudal .....	181	.....	.....
Depth of body .....	78	2½	.....
Head .....	45	4	.....
Snout .....	13	.....	3½
Eye .....	13	.....	3½
Maxillary .....	17	.....	2½
Pectoral fin .....	70	2½	.....
Chord of the curve of the lateral line .....	56	3½	.....

42. *Trachynotus fasciatus* Gill.*Panpanito.*

*Trachynotus fasciatus* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 86 (*Cape San Lucas*); Jordan and Gilbert, Proc. U. S. Nat. Mus. 1882, 359 (*Cape San Lucas*); Jordan, Proc. U. S. Nat. Mus. 1885, 375; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 232 (*Porto Escondido, Mexico*); Günther, Fishes of Central America, 1864, 434 (*San José; Panama*).

*Trachynotus glaucoides* Günther, Proc. Zool. Soc., 1864, 150.

Seven specimens were obtained, three of which give the following measurements:

	1	2	3
	mm.	mm.	mm.
Total length .....	158	120	210
Length to base of caudal .....	110	85	147
Head .....	32	28	39
Depth .....	58	40	77
Length of longest dorsal ray .....	48	36	89
Length of longest anal ray .....	45	35	89
Length of caudal lobe .....	.....	56	70
Length of middle caudal rays .....	.....	13	.....
Length of pectoral rays .....	.....	.....	32
Distance from snout to procumbent spine .....	.....	.....	60
Distance from procumbent spine to base of caudal .....	.....	.....	107
Head in length .....	3½	3	3½
Depth in length .....	2	2½	2
Eye in head .....	3½	3½	4

In the largest specimen (No. 3), the eye is about equal to the length of the snout, while in the others it is a little greater than the snout.

The origin of the anal is midway between the tip of the snout and the base of the caudal.

43. *Nematistius pectoralis* Gill.*Pez de Gallo.*

*Nematistius pectoralis* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 259 (*Cape San Lucas*); Steindachner, Ichthy. Beitr. iv, 11, 1875 (*Panama and Magdalena Bay*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 277 (*Picheluogo, Lower California*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1885, 375; Jordan, Cat. Fish. N. A., 72.

Great numbers of small specimens of this fish were seen, but no large ones.

Fifty-two specimens were retained.

One of the largest of these gave the following measurements:

	mm.
Total length .....	162
Length to base of caudal .....	130
Depth .....	45
Head .....	41
Eye .....	10
Snout .....	10
Longest dorsal rays .....	85
Length of pectoral .....	39

44. *Oligoplites altus* (Günther).*Curel.*

*Chorinemus altus* Günther, Fishes of Central America, 1866, 433 (*Panama*).

*Oligoplites altus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 374 (*Panama*); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 106 and 110 (*Mazatlan and Panama*); Jordan, Proc. U. S. Nat. Mus. 1885, 375 (*Mazatlan; Panama*); Jordan, Cat. Fish. N. A., 1885, 72.

Head,  $3\frac{1}{2}$  (4) to  $4\frac{1}{2}$  ( $5\frac{1}{3}$ ); depth, 3 ( $3\frac{1}{2}$ ) to  $3\frac{1}{2}$  ( $4\frac{1}{3}$ ); eye in head,  $3\frac{1}{2}$  to 4; eye in snout, 1.

This differs chiefly from *O. saurus* in the deeper body and shorter snout. The maxillary reaches beyond the eye. Its length is greater than given by Günther, it being contained  $1\frac{1}{3}$  times in the length of the head. Otherwise Günther's description applies very well to our specimens.

Of six specimens in our collection, four present the following measurements:

	1	2	3	4
	mm.	mm.	mm.	mm.
Total length .....	56	45	107	86
Length to base of caudal .....	45	36	90	70
Head .....	14	11	29	17
Depth .....	16	13	26	20
Eye .....	4	3	5	5
Snout .....	3	3	6	5

45. *Oligoplites saurus* Bloch & Schneider.

*Scomber saurus* Bloch & Scheider, 1801, 32.

*Chorinemus occidentalis*, Günther, Cat. Fish., II, 1860, 475 (various West Indian localities).

*Oligoplites inornatus* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 166 (*Panama*).

*Chorinemus inornatus* Günther, Fishes of Central America, 1866, 433.

*Oligoplites occidentalis*, Jordan, Proc. U. S. Nat. Mus. 1880, 18 (*East Florida*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 374 (*Panama*); Jordan & Gilbert, Synopsis, 1882, 447; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 240 (*Pensacola*); Goode & Bean, Proc. U. S. Nat. Mus. 1882, 235 (*Gulf of Mexico*).

*Oligoplites saurus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 625 (*Panama*); Jordan, Cat. Fish. N. A., 1885, 72; Jordan, Proc. U. S. Nat. Mus. 1885, 375 (*Panama*; *Mazatlan*).

The one specimen we have is 102 millimetres long, or 88 millimetres to base of caudal fin. The head is contained four times in length to base of caudal; eye,  $4\frac{1}{2}$  in head or  $1\frac{1}{2}$  in snout. The depth is one-fifth of the total length.

46. *Centropomus undecimalis* (Bloch).

*Sciæna undecimalis* Bloch, Ichthy., 303, 1801; Vaillant & Bocourt, Miss. Sci. au Mex., IV, 17, 1874.

*Centropomus undecimalis*, Günther, Cat. Fishes, I, 79, 1859.

*Centropomus appendiculatus* Poey, Memorias de Cuba, II, 119, 1860; Günther, Fishes Cent. America, 406, 1866.

*Centropomus viridis* Lockington, Proc. Cal. Acad. Nat. Sci. 1877, 16.

*Centropomus undecimalis*, Jordan & Gilbert, Synopsis Fishes N. A., 528, 1882; Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 106, 110; *ibid.*, Gilbert, 112 (*Punta Arenas*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 241, 625; Goode & Bean, Proc. U. S. Nat. Mus. 1882, 238; Jordan, Proc. U. S. Nat. Mus. 1884, 78; Jordan, Cat. Fishes N. A., 1885, 81; Jordan, Proc. U. S. Nat. Mus. 1885, 376; Jordan, Proc. U. S. Nat. Mus. 1886, 39, 578.

Four specimens were obtained. In one of these the preorbital was distinctly serrated; in others the serration was less distinct, while in one it was hardly perceptible.

D. VIII, 1-9, A. III, 6. Scales 10-73-12.

The measurements of three specimens are given below:

	1	2	3		1	2	3
	mm.	mm.	mm.		mm.	mm.	mm.
Total length .....	210	180	204	Maxillary .....	27	17	18
Length to base of caudal .....	176	156	185	Pectoral fin .....	33	26	30
Depth .....	43	43	41	Ventral fin .....	34	29	33
Head .....	64	51	61	Third dorsal spine .....	31	26	27
Eye .....	10	11	10	Fourth dorsal spine .....	29	24	25
Interorbital space .....	8	9	8	Second anal spine .....	31	30	30
Preorbital .....	4	7	6	Third anal spine .....	30	31	28
Snout .....	17	14	16				

47. *Centropomus grandoculatus* Jenkins & Evermann.

*Robalo*.

*Centropomus grandoculatus* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 139, (*Guaymas*).

Not common,



48. *Diplectrum radiale* (Quoy & Gaimard).*Aguavina.*

*Serranus radialis* Quoy & Gaimard, Voyage Freycinet, 316 (*Rio Janeiro*); Cuvier & Valenciennes, Hist. Natur. des Poiss., II, 243, 1828.

*Serranus radialis*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 274 (*Punta San Ignacio, Mexico*); Jordan, Proc. U. S. Nat. Mus. 1895, 376 (*Panama; Mazatlan*).

*Centropristis radialis*, Günther, Cat. Fishes, I, 83, 1859 (*Bahia*).

*Centropristis ayresi* Steindachner, Ichthyol. Notizen VII, 1, Taf. 1, Fig. 1, 1868 (*Santos*).

*Centropristis radialis*, Steindachner, Ichthyol. Beiträge IV, 6, 1875.

Common; about a dozen specimens are in our collection.

We have compared these with specimens from Havana and Panama, and find that some specimens have six rows of scales on the cheek and no notch in the preopercular margin; others show seven, eight, and ten rows of scales on the cheek and a more or less evident angle in the margin of the preopercle (*radiale*).

All of our specimens are some lighter, and the caudal spot is more pronounced than in the Havana specimen, and are also a little lighter than those from Panama.

Six of our Guaymas specimens measure as follows:

	81	478	479	480	481	482
	mm.	mm.	mm.	mm.	mm.	mm.
Total length	225	175	190	60	205	183
Length to base of caudal	175	142	150	50	160	144
Depth	52	35	40	18	44	38
Head	63	50	55	14	59	54
Eye	13	11	12	6	13	11
Snout	15	13	12	5	15	13
Interorbital space	12	11	10	3	11	10
Preorbital	9	6	8	2	9	7
Maxillary	30	19	25	5	28	24
Pectoral		32	35	12	40	35
Ventral		27	28	10	31	28
Ninth dorsal spine					13	13
Tenth dorsal spine					13	13
Head in length to base of caudal	2.8	2.8	3	2.7	2.7	2.7
Depth in length	4	3.75	4	3.63	3.63	3.63
Eye in head	4.5	4.6	2.3	4.6	5	5
Eye in snout	1+	1	1-	1+	1+	1+

49. *Serranus maculato-fasciatus* (Steind.).*Cabrillo Pinto.*

*Serranus maculato-fasciatus* Steindachner, Ichthyol. Notizen VII, 5, Taf. 2, 1868 (*Mazatlan*); Vaillant & Bocourt, Miss. Sci. au Mex., IV, 72, 1874.

*Serranus maculofasciatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1890, 456 (*San Pedro; San Diego*); Jordan & Jony, Proc. U. S. Nat. Mus. 1881, 12 (*San Diego Bay*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 46 (*San Pedro; San Diego*); Jordan & Gilbert, Synopsis, 1882, 536; Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 (*Mazatlan*); Jordan, Proc. U. S. Nat. Mus. 1885, 376 (*Mazatlan*); Jordan, Cat. Fishes N. A., 1885, 83.

This is an abundant fish in this locality, and is perhaps the most important food fish found here.

Color in life: dirty yellowish white, covered with dark yellowish spots, thickest on the back, these changing to brown in alcohol; belly with few or no spots; tip of lower jaw darker; iris orange; pectoral and anal fins blue. The young have a black lateral band from above the eye straight to the middle of the soft dorsal, another from the eye to the upper base of the caudal fin, and still a third from the pectoral to the lower base of the caudal.

These colors make it a very handsome fish when alive.

The teeth are less developed than in most species of the genus, and the dorsal fin has its last spines much shorter than the first few. These are the characters which Girard used to separate his genus *Paralabrax* from *Serranus*, and if these be of generic importance, this species will, of course, fall in *Paralabrax*. Head  $2\frac{3}{4}$ ; depth  $3\frac{1}{2}$ ; eye in head 5; scales 12-82-20; D. X. 14; A. III, 7.

Measurements (in millimetres) of nine specimens give the following results:

	466	467	468	469	470	471	39	90	835
Total length.....	180	165	148	172	162	160	155	283	212
Length to base of caudal.....	150	140	123	143	135	125	125	233	202
Head.....	56	52	45	53	50	50	50	89	75
Depth.....	41	40	35	40	35	35	35	65	60
Eye.....	10	10	10	12	10	10	10	15	14
Snout.....	18	15	13	15	15	14	15	25	22
Interorbital.....	10	9	8	10	9	8	9	14	13
Preorbital.....	9	7	6	7	7	6	7	15	12
Pectoral.....	30	30	29	32	30	29	30	48	40
Ventral.....	30	25	25	29	27	27	25	44	39
Longest dorsal spine (fourth).....	28	27	24	27	25	25	23	42	44
Longest dorsal ray.....	18	17	16	20	15	16	20	32	20
Longest anal spine (third).....	11	12	12	14	12	11	14	18	13
Longest anal ray.....	23	23	20	22	17	21	22	34	30
Head in length to base of caudal.....	$2\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{7}{10}$	$2\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{3}{4}$
Depth in length to base of caudal.....	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$
Eye in head.....	5	5	4	4	5	5	5	6	5

### 50. *Promicropus guttatus* (L.).

*Merito* of the fishermen.

One small specimen 116 millimetres long. Head  $2\frac{1}{2}$  (3); depth  $5\frac{1}{2}$  (3 $\frac{1}{2}$ ); eye in head 5—equal to snout. D. XI, 15; A. III, 7; scales about 85.

All of the Pacific coast references to *P. itaiara* mean this species.

### 51. *Mycteroperca jordani* Jenkins & Evermann.

*Baya*.

(Plate I.)

*Epinephelus jordani* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 140 (*Guaymas*).

Rather common. This interesting and valuable food fish is known as *Baya* by the local fishermen.

If *Mycteroperca* and *Epinephelus* are to be separated, as they perhaps should be, this species belongs in the first.

52. *Epinephelus analogus* Gill.*Pintitas.*

For full synonymy *vide* Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 393.

One small specimen, 142 millimetres long.

53. *Lobotes surinamensis* (Bloch & Schneider).*Viejo.*

*Holocentrus surinamensis* Bloch & Schneider, Systema Ichthyologia, 1801, 316 (*Surinam*).

*Lobotes surinamensis*, Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 110 (*Panama*):

Gilbert, 112 (*Punta Arenas*); Jordan, Proc. U. S. Nat. Mus. 1885, 378 (*Panama*).

We secured but one small specimen, 115 millimetres in total length. This we have compared with a specimen of nearly the same size from Charleston, South Carolina, in Dr. Jordan's collection. In ours the preopercular spines are more numerous and very much smaller, the base of the anal fin is longer, the depth of the body is not so great, and the profile is steeper. The eye is longer than the snout, and the color is much darker than in the Charleston specimen. D. XI, 16; A. III, 11; scales 10-44-17.

54. *Xenistius californiensis* (Steindachner).*Roncador.*

*Xenichthys californiensis* Steindachner, Ichthyol. Beiträge III, 3, 1875 (*San Diego*); Sitzber. Ak. Wiss. Munich, LXXII, 1875; Streets, Bull. U. S. Nat. Mus. VII, 43, 1877 (*Cerros Island*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 47 (name only); *ibid.*, 278 (*Cerros Island*); Jordan & Gilbert, Synopsis, 1882, 547.

*Xenistius californiensis*, Jordan, Proc. U. S. Nat. Mus. 1885, 378 (name only); Jordan, Cat. Fish. N. A., 1885, 86.

Common; numerous specimens were taken.

In life: white below, back greenish, with greenish-brown stripes.

Measurements of eleven specimens in millimetres:

	421	419	418	417	416	11	3	55	420	605	80
Total length .....	133	150	145	140	153	145	140	145	145	175	174
Length to base of caudal .....	110	120	120	115	130	120	110	120	120	143	149
Head .....	36	42	40	36	44	40	38	40	39	45	45
Depth .....	39	26	36	31	38	33	32	34	36	40	41
Eye .....	11	13	13	12	14	12	11	12	11	13	14
Snout .....	10	11	11	10	11	11	9	10	10	12	12
Preorbital .....	4	4	4	4	4	4	4	4	4	4	4
Pectoral fin .....	27	29	32	31	30	27	29	32	30	35	40
Ventral fin .....	19	20	25	20	24	22	19	20	20	27	25
Length of fourth dorsal spine .....	19	18	23	18	19	21	20	20	20	25	27
Length of third anal spine .....		13	13	12	14	14	13	13	13	17	16
Head in length .....	3+	3-	3	3½	3-	3	3-	3	3	3+	3½
Depth in length .....	3½	3½	3½	3½	3½	3½	3½	3½	3½	3½	3½
Eye in head .....	3+	3+	3	3	3+	3½	3½	3½	3½	3½	3

55. *Hoplopagrus güntheri* Gill.*Pargo Raisero* of the local fishermen.

*Hoplopagrus güntheri* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 253 (*Cape San Lucas*); Steindachner, Beiträge vi, 1, Tafel 1, 1878 (*Altata*); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 and 112 (*Mazatlan*; *Punta Arenas*); Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 429 (*Cape San Lucas*; *Punta Arenas*; *Mazatlan*); Jordan, Proc. U. S. Nat. Mus. 1885, 378 (*Mazatlan*); Jordan, Cat. Fishes N. A., 1885, 86.

Apparently not very common. It will be seen that the measurements of the two small specimens obtained by us agree pretty well with those given by Jordan & Swain of a specimen the length of our largest.

	32	115	863
	mm.	mm.	mm.
Total length .....	145	165	105
Length to base of caudal .....	118	125	86
Head .....	47	52	33
Depth .....	55	62	38
Eye .....	11	12	9
Snout .....	19	22	13
Preorbital .....	11	13	7
Interorbital .....	12	13	8
Longest dorsal spine (fourth) ..	21	24	14
Last dorsal spine .....	12	14	10
First anal spine .....	9	10	6
Second anal spine .....	16	20	13
Pectorals .....	38	43	26
Ventrals .....	31	35	22
Longest dorsal ray .....	23	24	16
Longest anal ray .....	25	27	17
Head in length .....	2½ (3+)	2½ (3½)	2½ (3½)
Depth in length .....	2½ (2½)	2½ (2½)	2½ (2½)
Eye in head .....	4½	4½	3½
Eye in snout .....	1½	1½	1½

D. X, 14; A. III, 9.

From the above it will be seen that, as compared with Dr. Gill's specimen, our specimens have the depth some greater, the head and snout each a little shorter, and the preorbital is not so deep. The pectoral fin and the longest dorsal and anal spines in ours are some shorter. We find the preopercle and suprascapular bone quite strongly serrate.

Color in life: breast and belly maroon purple, becoming less distinct on opercles and body; upper parts dark brown, with six double bands running obliquely downward and backward, the fourth and fifth pairs appearing as one. There is a large jet black spot upon the base of the caudal peduncle and extending some little upon the posterior rays of the soft dorsal.

Color in alcohol as given by Jordan & Swain (*l. c.*), except that the black spot on base of caudal peduncle and last rays of soft dorsal is very distinct.

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56. *Lutjanus argentiventris* (Peters).

*Mesoprion argentiventris* Peters, Berlin. Monatsber., 1869, 707 (*Mazatlan*).

*Mesoprion griseus* Günther, Fish. Centr. Am., 385, 1866 (not of Linnaeus).

*Lutjanus argentivittatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 354 (a misprint for *L. argentiventris*); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107, 110 (*Mazatlan*; *Panama*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 625 (*Panama*).

*Lutjanus argentiventris*, Jordan, Proc. Acad. Nat. Sci. Phila. 1883, 295; Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 431 and 434; Jordan, Proc. U. S. Nat. Mus. 1885, 378; Jordan, Cat. Fishes N. A., 1885, 87.

Depth, 2.7 (3.4); head, 2.6 (3.3); eye, 4.2.

Scales, 5-45-12, the rows above the lateral line parallel with it.

Color in life: belly and lower portion of sides light red; upper parts grayish, with blue reflections; a bright blue horizontal line just below the eye, extending from in front of the eye to the opercular flap.

This is one of the most important food fishes at Guaymas. Ten specimens were obtained.

The measurements of five of these specimens are here given:

	1	2	3	4	5
Total length	208	130	130	165	155
Length to base of caudal	164	105	103	132	122
Depth	61	40	37	50	47
Head	63	40	38	51	48
Eye	15	10	10	12	11
Snout	20	13	13	18	18
Interorbital	12	8	9	9	10
Preorbital	12	6	6	8	8
Maxillary	23				
Ventral fin	37	20	24	27	27
Pectoral fin	48	25	26	37	34
Longest dorsal spine (fourth)	28	15	15	17	18
Longest anal spine (second)	23	17	16	20	20
Longest dorsal ray	25				
Longest anal ray	28				

57. *Lutjanus novemfasciatus* Gill.

*Lutjanus novemfasciatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 251 (*Cape San Lucas*).

*Lutjanus prieto* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1831, 232, 338, 353, 355 (*San Blas*; *Mazatlan*). (Full description on page 353.)

*Lutjanus pacificus* Vaillant & Bocourt.

Two specimens give the following measurements in millimetres:

	128	856		128	856
Total length	320	180	Maxillary (exposed portion 20)	39	16
Length to base of caudal	254	145	Pectoral	68	35
Head	95	55	Ventral	51	29
Depth	81	51	Longest dorsal spine (fourth)	34	29
Eye	17	12	Third dorsal spine	32	28
Snout	31	18	Second anal spine	19	15
Interorbital	17	10	Third anal spine	30	13
Preorbital	17	9			

Head, 2½ (3¼); depth, 3 (4); eye, 5.6 to 4.6; D. X, 14; A. II, 8 in No. 128, III, 7 in the others.

The interorbital is wider and the preorbital narrower than in *L. cubera* Poey, with which this is closely related. The maxillary reaches to the middle of the pupil. Canine teeth large in both jaws, two very large ones in the upper and ten in the lower. The soft dorsal and anal fins both rounded, the latter less than half length of head. Caudal lunate, not at all forked. Gill rakers stout, seven below the angle. Six rows of scales on the cheek, seven on the opercle, one on the subopercle, one on the interopercle, and two series on the occipital region.

58. *Lutjanus guttatus* (Steindachner).

*Pargo Chibato* of the local fishermen.

*Mesoprius guttatus* Steindachner, Ichthyol. Notizen ix, 18, 1869, Tafel VIII (*Mazatlan*).

*Lutjanus guttatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 354 (*Mazatlan*); (partial description); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 625 (*Panama*); (name only); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 (*Mazatlan*), and 110 (*Panama*); Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 447 (*Mazatlan*; *Panama*); (full description); Jordan, Proc. U. S. Nat. Mus., 1885, 378 (*Mazatlan*; *Panama*); (name only); Jordan, Cat. Fish. N. A., 1885, 87.

D. X, 12; A. III, 8; scales, 6-48-14.

Color in life: general color bright red, clearest on caudal and outer edge of dorsal fin; anal and pectorals bright yellow, edged with white; body covered with short oblique, brownish lines; a large black spot mostly above the lateral line just below posterior portion of spinous dorsal. Inside of mouth yellow. Iris red.

This is a common and valued fish at Guaymas.

We here give measurements in millimetres of four specimens:

	619	620	677	1
Total length.....	190	182	140	320
Length to base of caudal.....	150	145	110	260
Head.....	56	54	43	87
Depth.....	58	53	40	87
Eye.....	13	13	11	17
Snout.....	17	18	13	31
Interorbital.....	11	11	8	16
Preorbital.....	8	9	7	15
Pectoral.....	44	41	30	68
Ventral.....	33	33	24	51
Head in length.....	2.7 (3.4)	2.7 (3.4)	2.6 (3.2)	3 (3.6)
Depth in length.....	2.6 (3.5)	2.7 (3.4)	2.75 (3.5)	3 (3.6)
Eye in head.....	4½	4½	4	5
Eye in snout.....	1½	1½	1½	1½

59. *Lutjanus colorado* Jordan & Gilbert.

*Pargo Raisero*.

*Lutjanus colorado* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 338, 351 (description), and 355 (*Mazatlan*); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 (*Mazatlan*), 112 (*Punta Arenas*); Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 457 (*Mazatlan*; *Panama*); Jordan, Proc. U. S. Nat. Mus. 1885, 378; Jordan, Cat. Fish. N. A., 1885, 87.

This fish does not appear to be common as but three specimens were taken.

A full description is given by Jordan & Gilbert (*op. cit.*). In our specimens (113, 137, and 170 millimetres long respectively) the eye is greater than the interorbital width, and the conical teeth of the lower jaw are smaller than those of the upper jaw.

This species is, curiously enough, confounded by the Guaymas fishermen with *Hoplopagrus guntheri* under the name *Pargo Raiscro*.

#### 60. *Orthopristis inornatus* (Gill).

*Microlepidotus inornatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 256 (Cape San Lucas).  
*Orthopristis inornatus*, Jordan, Cat. Fish. N. A., 1885, 83; Jordan, Proc. U. S. Nat. Mus. 1885, 379.

Head, 3.3 in length of body to the base of the caudal; depth of body 3.1.

Dorsal fin, XIII, 1-15; anal fin, III-12; scales, 9-78-20.

Color in alcohol: steel blue, with metallic reflections above, lighter below; belly almost white; sides of body with seven narrow, light horizontal stripes, three above the lateral line and four below; those below are more distinct; those above often interrupted and obscure; fins plain and somewhat dusky.

Body stout, compressed posteriorly, deepest at about below the fourth dorsal spine. Eye, 4.3 in head; snout blunt, 3.5 in head.

The maxillary slipping under the preorbital for its whole length and just reaching the vertical from the anterior margin of the orbit.

Teeth in both jaws; bands of minute teeth, with the outer series projecting slightly. No teeth on vomer or palatines.

Gill rakers on the anterior arch 8-16, slender, one-third the diameter of the eye, much shorter on the succeeding arches.

The slit behind the fourth arch is 4.3 in head. Head covered with small scales, except snout, maxillaries, and anterior part of lower jaw. Scaled sparingly on the posterior portions of soft dorsal and anal. Caudal fin scaled. Posterior margin of the opercle rounded, entire, no perceptible flap. Vertical limb of the preopercle concave, weakly serrated, lower limb entire.

Five specimens were obtained. The measurements of two are given below:

	884	406
Total length.....	182	150
Length to base of caudal.....	150	120
Depth.....	47	40
Head.....	45	35
Eye.....	11	11
Preorbital.....	5	5
Interorbital.....	12	12
Snout.....	13	13
Pectoral.....	40	40
Ventral.....	37	37
Longest dorsal spine (fourth).....	23	23
Longest anal spine (third).....	8	8

61. *Orthopristis chalceus* (Günther).

*Pristopoma chalceum* Günther, Proc. Zool. Soc. Lond. 1864, 146 (*Panama*).

*Pristopoma kneri* Steind., Ichth. Notiz. VIII, 1869, 3 (*Mazatlan*).

*Pomadasys chalceus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 387; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 625 (*Panama*); Jordan & Gilbert, Bull. U. S. Fish Comm. 1892, 107, 110.

*Orthopristis chalceus*, Jordan, Proc. U. S. Nat. Mus. 1885, 387; Jordan, Cat. Fishes N. A., 88, 1885.

Head, 3 in body to base of caudal; depth 3. Dorsal, XII-15; Anal, III-11. Scales, 8-55-18.

Color in life: body gray, with numerous narrow, brown, wavy lines running the direction of the scales, horizontal below the lateral line, oblique above.

Dark indistinct spot on the humeral region. Among the numerous specimens, some had, in addition to these marks, dark indistinct cross bands or blotches. These, however, varied very much.

Inside of the mouth, orange. Dorsal, dark brown, with a whitish stripe along about the middle of the fin, extending nearly the whole length. This was much more distinct in some than in others.

Each scale on the upper and anterior part of the body with a blue spot with a metallic reflection.

Body somewhat slender, compressed, deepest at below the fourth dorsal spine.

Profile of the head nearly straight, gently ascending, curved over the neck to the dorsal.

Eye, 4-4½ in head; snout, 2.7; preorbital slightly less than diameter of eye.

The maxillary does not quite reach the anterior margin of the orbit.

Teeth small; more than one series of curved teeth projecting beyond the rest in each jaw.

Gill-rakers on the anterior arch small and slender, 8-12.

The slit behind the fourth gill is less than the diameter of the eye.

Snout, front portion of preorbital, maxillaries, and lower jaws naked; the rest of the head covered with very small scales; dorsal and anal naked; caudal, base of pectoral, and under side of ventral covered with small scales.

Posterior margin of the opercle rounded, entire, no perceptible flap; posterior margin straight, or nearly so, very finely pectinate; lower limb entire, slightly rounded, making about a right angle with posterior margin.

Anal spines slender, the third the longest, a little longer than the diameter of the eye.

This fish is very abundant, being one of the most common species taken in the seine. A considerable variation of color is seen among them.





The measurements of four specimens are given below :

	782	15	787	788
Total length .....	215	162	150	160
Length to base of caudal .....	175	133	125	129
Depth .....	57	48	39	43
Head .....	59	43	39	40
Eye .....	13	10	10	9
Snout .....	22	16	14	15
Preorbital .....	13	8	7	8
Interorbital .....	16	10	10	11
Pectoral .....	40	34	30	30
Ventral .....	37	26	25	24
Longest dorsal spine (fourth) .....	23	22	20	18
Longest anal spine (third) .....	15	12	13	12
Second anal spine .....	11	11	12	11
Second soft dorsal ray .....	15	14	12	12
Second soft anal ray .....	18	16	13	14
Maxillary .....	12	11	11	10

## 62. *Pomadasis elongatus* (Steindachner).

*Pristipoma leuciscus elongatus* Steindachner, Neue und Seltene Fisch-Arten aus des K. K. Zoologischen Museen zu Wien, Stuttgart und Warschau, 1879, 30, Tafel 9, Fig. 2 (*Tumbez, west coast of South America*).

*Pomadasis leuciscus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 387 (in part only) (*Mazatlan; Panama*).

*Pomadasis elongatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 352; Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 (*Mazatlan*), 110 (*Panama*); Jordan, Proc. U. S. Nat. Mus. 1885, 378; Jordan, Cat. Fish. N. A., 1885, 88.

We have six specimens which we refer to this species, though it is not clear to us that *Pristipoma leuciscus elongatus* Steind. can be separated from *Pristipoma leuciscus* Günther. The former is said to have the body more slender, but Günther gives the depth of the latter as 3 to  $3\frac{1}{2}$  in length to base of caudal, and this agrees well with our examples. Jordan & Gilbert, in the Proceedings for 1881 (*op. cit.*), speaking of their specimens of *Pomadasis leuciscus* from Mazatlan and Panama, say that all but two "are slenderer, with more pointed snout and deeper sub-orbital, the anal spines being quite small, the second  $3\frac{1}{2}$  to 4 in head." This of course means Steindachner's variety *elongatus*, and agrees with ours, unless it be that ours are but little if any slenderer than *leuciscus*, and the anal spines are not quite so small. The head of ours agrees exactly with Steindachner's figure (as to shape, length of snout, depth of suborbital, eye, membranous flap upon border of anterior nostril, and squamation of cheek), but instead of about seven rows of scales upon the opercle, there are but four or five, agreeing in this last respect with Günther's figure of *leuciscus*. The anal spines agree better with *leuciscus*, the second being large and strong ( $3\frac{1}{2}$  in head), and the third is longer and more slender (less than  $3\frac{1}{2}$  in head).

A light lateral band, about one scale in width, begins at the posterior margin of the opercle just above the origin of the pectoral and extends backward in a direct line, meeting the lateral line under the posterior fourth of the soft dorsal, and continuing direct to the base of the caudal chiefly below the lateral line.

In the center of each scale in this band is a faint dark blotch, these forming a fairly distinct darker line through the middle of the light one. There are three other faint dark bands along the sides, one above and two below the light band.

These markings are least distinct toward the ends. There is a dark blotch upon the upper edge of the opercle.

Describing the color markings of his three specimens from Tumbez, Dr. Steindachner says:

Ausnahmslos zieht eine silberhelle, oben und unten ziemlich breit grau eingefasste Längsbinde über der Höhe der Pectorale in horizontaler Richtung vom Schultergürtel zur Caudale und grenzt erst am Schwanzstiele nach oben an die Seitenlinie. Sie nimmt mit Ausschluss der dunkleren Einfassung die Höhe einer ganzen Schnuppenreihe (der vierten) unter dem Beginne der Seitenlinie ein, ist jedoch zuweilen im vordersten Theile des Rumpfes nicht sehr scharf ausgeprägt, und wurde wohl nur aus diesem Grunde von Dr. Günther nicht erwähnt.

It should perhaps be added that Dr. Steindachner does not use the name *elongatus* in connection with his description, but uses it only with his figure.

### 63. *Pomadasis axillaris* Steindachner.

*Pristipoma axillare* Steindachner, Ichthyol. Notizen VIII, 7, Tafel 4, 1869 (*Mazatlan*).  
*Pristipoma leucicous*, Streets, Bull. U. S. Nat. Mus. VII, 49, 1877 (in part) (*Lower California*).

*Pomadasis axillaris*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 387 (*Mazatlan*);  
Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 (*Mazatlan*) (name only);  
Jordan, Proc. U. S. Nat. Mus. 1885, 379; Jordan, Cat. Fishes N. A., 1885, 88.

Head 3.1 (3.9); depth 3 (3.6); eye 4.7.

The one specimen we obtained measures 220 millimetres in total length, or 183 millimetres to the base of the caudal. The eye is contained a little more than  $1\frac{1}{2}$  times in the snout, and equals the interorbital and preorbital; the maxillary does not reach vertical at front of eye. Gill rakers 14, well developed. Scales 5-50-9, four rows on the opercle.

Pectoral fin about as long as head. D. XI, 1-13; A. III, 7.

Our specimen agrees very closely with Steindachner's description.

### 64. *Pomadasis macracanthus* (Günther).

*Pristipoma macracanthum* Günther, Proc. Zool. Soc. London 1864, 146 (*Chiapam*);  
Günther, Fish. Centr. Am., 416, Pl. 64, Fig. 1, 1866 (*Chiapam*).

*Pomadasis macracanthus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 356 (*Mazatlan*; *Punta Arenas*; *Panama*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 625 (*Panama*) (name only); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 (*Mazatlan*); 110 (*Panama*); 112 (*Punta Arenas*) (name only); Jordan, Proc. U. S. Nat. Mus. 1885, 379 (*Mazatlan*; *Panama*) (name only); Jordan, Cat. Fishes N. A., 1885, 89; Jordan, Proc. U. S. Nat. Mus. 1888, 330 (name only).

Eight individuals of this species were brought home by us. It is a common fish at Guaymas, and, like all others of the family found there, is of value as a food fish.

We here give measurements in millimetres of three examples :

	43	850	27123
Total length.....	205	155	280
Length to base of caudal.....	173	130	185
Head.....	65	48	58
Depth.....	65	50	58
Eye.....	13	11	13
Snout.....	26	19	21
Interorbital width.....	15	12	13
Preorbital depth.....	16	11	14
Snout to origin of dorsal.....	76	58	70
Snout to pectoral.....	65	49	59
Snout to ventral.....	68	50	63
Snout to anal.....	124	93	121
Head in length.....	2.66(3.10)	2.71(3.22)	2.84(3.44)
Depth in length.....	do.	do.	do.
Eye in head.....	5	4.4	4.5
Eye in snout.....	2	1.73	1.61

### 65. *Hæmulon maculicauda* (Gill).

*Roncador Rayado.*

*Orthostechus maculicauda* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 255 (*Cape San Lucas*).

*Hæmulon mazatlanum* Steindachner, Ichthyol. Notizen VIII, 12, Taf. vi, 1869 (*Mazatlan*).

*Hæmulon maculicauda*, Steindachner, Ichthyol. Beiträge III, 14, 1875 (*Acapulco*; *Mazatlan*).

*Diabasis maculicauda*, Jordan & Gilbert, Bull. U. S. Fish Comm. 1881, 325; *ibid.*, 1882, 110 (*Panama*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 362 (*Cape San Lucas*); *ibid.*, 372 (*Colima*); *ibid.*, 626 (*Panama*); Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 315 (*full description*).

*Hæmulon maculicauda*, Jordan, Proc. U. S. Nat. Mus. 1885 380 (*Panama*); Jordan, Cat. Fish. N. A., 1885, 89; Jordan, Proc. U. S. Nat. Mus. 1886, 537.

Common; known as *Roncador Rayado* by the Guaymas fishermen.

### 66. *Hæmulon flaviguttatum* Gill.

*Roncador.*

*Hæmulon flaviguttatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 254 (*Cape San Lucas*).

*Hæmulon margaritifera* Günther, Proc. Zool. Soc. London 1864, 147; Günther, Fish. Centr. Am., 419, Pl. 65, Fig. 2, 1869; (*Panama*).

*Hæmulon flaviguttatum*, Steindachner, Ichthyol. Beiträge III, 14, 1875 (*Mazatlan*; *Acapulco*; *Allata*; *Panama*); Streets, Bull. U. S. Nat. Mus. VII, 79, 1877 (*Lower California*).

*Diabasis flaviguttatus* Jordan & Gilbert, Bull. U. S. Fish. Comm. 1881, 324; *ibid.*, 1882, 107 (*Mazatlan*), 110 (*Panama*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 361 (*Cape San Lucas*); *ibid.*, 381 (*Panama*); *ibid.*, 626 (*Panama*).

*Hæmulon flaviguttatum*, Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 314 (*full description*); Jordan, Proc. U. S. Nat. Mus. 1885, 380 (*Mazatlan*; *Panama*); Jordan, Cat. Fish. N. A., 1885, 89.

*Hæmulon flaviguttatum*, Jordan, Proc. U. S. Nat. Mus. 1886, 537.

A careful examination of many specimens (24) in our collection shows some differences from the descriptions hitherto published.

The head is contained in length to base of caudal  $3\frac{1}{2}$  instead  $3\frac{3}{4}$  times; the preorbital is a little narrower; the gill rakers are 18 or 19 instead of

22; the longest anal ray is contained in length of head at least  $3\frac{3}{4}$  times, and the second anal spine is contained 3 to  $3\frac{1}{4}$  times in the head.

In life, the belly is whitish with some fine black dots; sides and back olivaceous, each scale with a light spot, these forming longitudinal lines below the lateral line, but oblique ones above it. The dorsal fin is golden brown, the pectorals and anal bronze.

67. *Hæmulon schranki* Agassiz.

*Hæmulon schranki* Agassiz, Spix, Pisc. Brésil., 121, Pl. 69, 1829.

*Hæmulon caudimacula* Steindachner, Ichthyol. Beiträge III, 15, 1875 (*Acapulco*; *Rio Janeiro*; *Rio Grande do Sul*; *Maranhão*). (Not of Cuv. & Val.)

*Hæmulon flaviguttatum*, Bean, Proc. U. S. Nat. Mus. 1880, 96 (*Colima*).

*Diabasis steindachneri* Jordan & Gilbert, Bull. U. S. Fish Comm. 1881, 322 (*Panama*; *Mazatlan*) (full description); *ibid.*, 1882, 107 (*Mazatlan*), 110 (*Panama*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 361 (*Cape San Lucas*), 372 (*Colima*).

*Hæmulon steindachneri*, Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 299; Jordan, Proc. U. S. Nat. Mus. 1885, 380 (*Mazatlan*; *Panama*); Jordan, Cat. Fishes N. A., 1885, 90; Jordan, Proc. U. S. Nat. Mus. 1886, 535 and 537.

A half-dozen specimens were secured.

Color in life, silvery, with tinge of yellow, greenish on back; a dark spot at base of caudal fin; all the fins old gold in color.

It seems pretty certain that *Hæmulon steindachneri* J. & G., should be identified with *Hæmulon schranki* Agassiz.

68. *Hæmulon sexfasciatum* Gill.

*Hæmulon sexfasciatum* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 254 (*Cape San Lucas*); Steindachner, Ichthyol. Beiträge III, 13, 1875 (*Panama*).

*Diabasis sexfasciatus*, Jordan & Gilbert, Bull. U. S. Fish Comm. 1881, 324; *ibid.*, 1882, 107 (*Mazatlan*), 110 (*Panama*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 361 (*Cape San Lucas*), 372 (*Colima*), 626 (*Panama*); Jordan, Proc. Acad. Nat. Sci. Phila. 1883, 286.

*Hæmulon maculosum* Peters, Berliner Monatsberichte, 705, 1869 (*Mazatlan*).

*Hæmulon sexfasciatum*, Jordan & Swain, Proc. U. S. Nat. Mus. 1884, 298; Jordan, Proc. U. S. Nat. Mus. 1885, 380 (*Mazatlan*; *Panama*); Jordan, Cat. Fishes N. A., 1885, 90; Jordan, Proc. U. S. Nat. Mus. 1888, 330 (*Tres Marias Islands*).

Our five specimens agree very closely with the published descriptions. They measure in total length 162, 176, 210, 210, and 215 millimetres respectively.

The young specimens are not as distinctly colored as the older ones.

69. *Calamus brachysomus* (Lockington).

*Sparus brachysomus* Lockington, Proc. U. S. Nat. Mus. 1880, 284 (*Lower California*).

† *Chrysophrys calamus* Günther, Fishes Cent. Amer. 1869, 386 (*Panama*).

*Sparus brachysomus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 277 (*Lower California*).

*Calamus bajonado* Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 (*Mazatlan*).

*Calamus brachysomus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1884; Review of the species of the genus *Calamus*, Jordan, Proc. U. S. Nat. Mus. 1885; Jordan, Cat. Fishes N. A., 1885, 90.

Color silvery, each scale with a pearly spot, forming longitudinal rows. In the young the head and body are crossed by eight or nine conspic-

uous brown bands, the first vertically through the eye, the second from the nape of the neck over the opercles, the third from just in front of the dorsal, passing down just behind the base of the pectoral; the remaining ones divide the space to the caudal, the last one being around the caudal peduncle. There are four dark cross-bands on the caudal fin. The dorsal, anal, and the ventrals are dusky. The snout and space between the eyes are dusky. These dark bands gradually disappear with age.

This fish is very abundant in the Bay of Guaymas. Since it often reaches a large size, it forms an important part of the fisherman's catch

#### 70. *Girella nigricans* (Ayres).

*Camarina nigricans* Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 81.

*Girella dorsimacula* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 244.

*Girella nigricans* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 456 (*California*); Jordan & Jouy, Proc. U. S. Nat. Mus. 1881, 12 (*California*); *ibid.*, Jordan & Gilbert, 47 (*Santa Barbara Islands*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 363 (*Cape San Lucas*); Jordan & Gilbert, Synop. Fish. N. A., 560, 1882; Rosa Smith, Proc. U. S. Nat. Mus. 1883, 234 (*Todos Santos Bay*); Rosa Smith, Proc. U. S. Nat. Mus. 1884, 553 (*San Cristobal, Lower California*); Jordan, Proc. U. S. Nat. Mus. 1885, 380; Jordan, Cat. Fish. N. A., 1885, 91.

Nine specimens of this fish were taken.

#### 71. *Kyphosus analogus* (Gill).

##### *Chopa.*

*Pimelepterus analogus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 245 (*Cape San Lucas*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 232 (*Porto Escondido, Mexico*; *Nichols*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 363. (Note on Gill's types.)

*Kyphosus analogus*, Jordan, Proc. U. S. Nat. Mus. 1885, 380 (in part) (*Mazatlan; Panama*).

*Kyphosus elegans*, Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 142 (*Guaymas*).

We took altogether nine specimens of *Kyphosi*, eight of which we refer to this species.

A reëxamination of all our material leads us to believe that we were in error in a former paper (Proc. U. S. Nat. Mus. 1888, 142) in referring the specimen now in the U. S. National Museum, and bearing the number 39635, to *Kyphosus elegans* (Peters). This, together with seven other examples in our collection, we now refer to *Kyphosus analogus* (Gill).

An examination of these specimens leads us to question the opinion expressed by Drs. Jordan & Gilbert, in the Proceedings U. S. National Museum 1882, 363, and later by Dr. Jordan, in the Proceedings U. S. National Museum 1885, 380, that *Pimelepterus analogus* Gill is the same fish that Peters described as *Pimelepterus elegans*.

Our specimens differ from Dr. Peters's description of *P. elegans* in the following particulars: *Kyphosus analogus* has much smaller scales, fewer teeth, narrower interorbital (as compared with the diameter of the eye), and has more rays in the soft dorsal and anal.

For purposes of comparison we append the following table:

	Peters's description of <i>K. elegans</i> .	Gill's description of <i>K. analogus</i> .	Our specimens of <i>K. analogus</i> .
Scales.....	11-56-12	13-75-20	13-70 to 76-20
Teeth in each jaw.....	38	22	24
Interorbital.....	Nearly twice diameter of eye.		1½ to 1½ times eye.
Dorsal.....	XI-12	XI-14	XI-14
Anal.....	III-13	III-13	III-13
Head in total length.....	4.5	4.5	4
Depth in total length.....	2.5	2.6 to 2.7	2.6

Measurements of five of the largest of our specimens are given in the following table:

	1	2	3	109	113
	<i>775 mm.</i>	<i>775 mm.</i>	<i>775 mm.</i>	<i>775 mm.</i>	<i>775 mm.</i>
Total length.....	130	123	126	170	140
Length to base of caudal fin.....	110	104	104	136	115
Length of head.....	30	31	30	38	35
Depth of body.....	51	45	45	65	56
Length of snout.....	9	9	9	12	11
Width of interorbital space.....	12	11	11	15	13
Diameter of eye.....	9	9	9	11	9
Length of maxillary from tip of snout.....	9	9	9	10	16
Length of sixth dorsal spine.....	12	11	12	16	13
Base of spinous dorsal.....	27	24	24	35	35
Base of soft dorsal.....	29	26	26	35	27
Height of soft dorsal.....	10	9	9	11	9
Length of second anal spine.....	5	5	5	8	6
Base of soft anal.....	23	22	23	30	25
Height of anterior portion of soft anal.....	11	10	10	15	11
Height of posterior portion of soft anal.....	8	8	8	10	9
Length of ventral fin.....	16	14	16	23	19
Length of pectoral fin.....	18	15	16	20	19

We here give Dr. Peters's description of *Kyphosus elegans*, from "D. Monatsber. d. Königl. Akad. d. Wiss. zu. Berlin."

*Pimblepterus elegans* n. sp.

B. 7, D. 11, 12: A. 3, 12 Lin. lat. 56; tr. ½.

Höhe zur Totallänge wie 1 : 2½, Kopflänge zu derselben wie 1 : 4½. Schnauze concav, etwas länger als das Auge, Oberkiefer bis zur Verticallinie des vorderen Augenrandes reichend. Die Breite des Interorbitalraums ist fast gleich dem doppelten Augendurchmesser. Zähne oben wie unten 38. Schuppen fest anliegend, die senkrechten Flossen bis zum Rande bedeckend. Braun mit rötlichbraunen Längslinien, unter Seitenlinie etwa 15 bis 16. Rand der Kiemendeckelhaut und Fleck unmittelbar hinter dem unteren Theile der Brustflosse Schwartz. Ein silberner Streif auf dem Präorbitale. Totallänge 0.<sup>m</sup> 290. Gekauft; angeblich aus Mazatlan.

## 72. *Kyphosus elegans* (Peters).

*Chopa.*

Head 3½ in body to base of caudal fin (4½ in total length). Depth 2 (2½); eye 3 in head; snout equals the eye. D. X-13; A. III-12. Scales 12-60-18.

Body elliptical, compressed; snout very blunt, anterior profile nearly vertical from lip to front of middle of eye where there is a broad angle, from which the arch is gentle and uniform to the origin of the dorsal fin.

Mouth small, horizontal, maxillary short, just reaching vertical of anterior border of eye; each jaw with a single series of close-set incisors, about twenty-six in number.

Dorsal fin long, its spines strong, depressible in a groove, the fifth to seventh longest, about  $2\frac{1}{2}$  in head; the soft portion rather lower, its last rays about  $3\frac{1}{2}$  in head.

Anal spines short, the second about  $4\frac{1}{2}$  in head; soft anal high, its anterior rays being longest and more than equaling half of head; the posterior rays of anal are contained  $3\frac{1}{2}$  times in head, and thus equal the last rays of the dorsal; caudal fin widely forked; caudal, pectorals, and ventrals well scaled at the base, while the soft parts of the dorsal and anal are densely scaled throughout. Scales rather large—sixty in lateral line—except on the fins, where they are very small, and about the head, where they are small and much crowded; the snout is naked.

Color in alcohol not noticeably different from that of *K. analogus*.

This species is closely related to *K. analogus* (Gill), from which it appears to differ in the larger scales, fewer scales in the lateral line, much higher anal fin, wider interorbital space, and more blunt snout.

It does not agree with Peters's description as to number of teeth in each jaw (Peters giving thirty-eight while our specimen has but twenty-six), the width of the interorbital and in the fin formulæ, but these discrepancies may be due to errors of observation or copying.

At our request Dr. F. Hilgendorf recently examined Peters's types and we are indebted to him for the following note: "Schuppen über L. 1, zähle ich 64–66 und ausserdem etwa 10 kleinere auf den Schwanzflosse. \* \* \* Die Höhe des ersten weichen Strahles der Analis beträgt 38<sup>mm</sup>. Die Basis-Länge der ganzen Flosse ist 68<sup>mm</sup>."

This, of course, shows that Peters's description is not accurate. We obtained but one specimen.

### 73. *Hermosilla azurea* Jenkins & Evermann.

#### PLATE I.

*Hermosilla azurea* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1898, 144. (Guaymas.)

—One of the most beautiful and interesting species of the collection.

### 74. *Upeneus grandisquamis* Gill.

*Upeneus grandisquamis* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 168 (West Coast of Central America); Günther, Fish. Centr. Am., 1864, 420 (Gill's description copied); Steindachner, Ichthyol. Beiträge IV, 1875, 6 (Panama) (description); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 363 (note on this species as compared with *U. dentatus*); *ibid.*, 378 (Colima) (name only); *ibid.*, 626 (Panama) (name only); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 107 (Masatlan), 111 (Panama); Hall & McCaughan, Proc. Acad. Nat. Sci. Phila. 1885, 155 (no specimens examined); Jordan, Proc. U. S. Nat. Mus. 1885, 381 (Masatlan; Panama) (name only); Jordan, Cat. Fish. N. A., 1885, 93.

*Upeneus tetraspilus* Günther, Proc. Zool. Soc. London 1864, 148 (Panama); Günther, Fish. Centr. Am. 1864, 420, Pl. 66, Fig. 1 (Panama).

Numerous specimens of this species were obtained. Measurements

of all of these (ten of which we give below) show but slight variations among the individuals.

The head is but very slightly greater than the depth, and is contained from 3 to  $3\frac{1}{2}$  in the body to base of caudal fin, while the depth varies from 3 to 3.6 in the same, this least depth being found in the smallest specimens.

The variation in the distance between dorsals is due in part to the difficulty of determining where the membrane of the first fin ends, as in some specimens it is more or less torn.

The scales are usually 2-31-5, but in one individual they seem to be 2-32-5, while in another they are 2-30-5.

	807	808	809	811	805	832	27126	27127	27129	831
Total length	125	108	152	135	171	112	180	185	172	173
Length to base of caudal	100	82	122	105	137	90	145	147	135	140
Head	32	27	39	32	41	29	48	47	45	45
Depth	31	26	37	30	41	25	45	46	44	42
Eye	8	7	9	8	11	8	10	11	11	11
Snout	14	10	18	15	20	13	21	22	20	20
Preorbital	10	8	13	8	15	9	13	16	14	16
Interorbital	9	7	10	8	11	8	12	12	11	11
Third dorsal spine	20	17	27	20	32	20	28	33	31	32
Head to margin of preopercle			38		31	21		33	31	32
Distance between dorsal fins	12	10	14	14	16	9	18	16	21	16
Base of first dorsal			21		25	17		28	26	26
Base of second dorsal			22		23	15		25	23	24
Ventrals	22	16	26		30	20	30	30	30	30
Pectorals	23	20	29		31	21	32	35	35	34
Snout to hind edge of orbit			26		30	20		32	30	30
Head in length	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{4}$	3	$3\frac{1}{4}$
Depth in length	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{4}$
Eye in head	4	4	$4\frac{1}{2}$	4	4	$3\frac{1}{2}$	$4\frac{1}{2}$	4	4	4

### 75. *Upeneus dentatus* Gill.

*Upeneus dentatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 256 (*Lower California*); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 363 (*Cape San Lucas*) (note on Gill's types); Hall & McCaughan, Proc. Acad. Nat. Sci. Phila. 1885, 154 (no specimens seen); Jordan, Proc. U. S. Nat. Mus. 1888, 330 (partial description of a specimen from *Tres Marias Islands*).

Three specimens were obtained by us. These, together with Dr. Gill's types from Cape San Lucas and one specimen  $10\frac{1}{4}$  inches long from Tres Marias Islands, examined by Dr. Jordan (*op. cit.*), are the only specimens of this species yet recorded.

Head, 3.4 (4.3); depth, 4 (5.1); eye, 3.8; D. VII-I, 8; A. I, 6; scales, 2-37-5.

The scales are much more deciduous than in the two other species found by us, and the upper parts are very much darker.

	827.	829.		827.	829.
Total length	210	210	First to second dorsal	21	20
Length to base of caudal	165	165	Base of first dorsal	29	30
Head	49	49	Base of second dorsal	22	21
Depth	41	41	Longest dorsal spine (second)	30	28
Eye	13	13	Pectorals	31	30
Preorbital	15	16	Ventrals	32	31
Interorbital	16	16	Snout to edge of preopercle	37	37
Snout	20	20	Snout to hind edge of orbit	32	31




76. *Upeneus rathbuni* sp. nov.

(No. 43241, U. S. National Museum.)

## PLATE II.

Head,  $3\frac{1}{2}$  ( $4\frac{1}{2}$ ); depth, 4 (5); D. VIII-I, 8; A. I, 6; scales,  $2\frac{1}{2}$ -41-6.

Body slender; dorsal outline well arched; profile from snout to origin of first dorsal regularly curved, except above the eyes, where it is very slightly flattened; from first dorsal to posterior end of second dorsal gently convex, and from there to the caudal slightly concave; ventral outline nearly straight to caudal fin; head triangular; snout blunt-pointed; least depth of caudal peduncle  $2\frac{3}{4}$  in head, and its length  $1\frac{1}{4}$  in the same; mouth slightly oblique; the maxillary, which is  $3\frac{1}{4}$  in head, greatly broadened behind, almost reaching anterior margin of orbit; preorbital deep and broad, its depth  $3\frac{1}{2}$  in head; lower jaw slightly included; barbels moderate, scarcely reaching posterior edge of opercles; preopercle very weakly serrate. Eye large,  $2\frac{3}{4}$  in head, or  $1\frac{1}{2}$  in snout. First dorsal spine *minute*, the second, third, and fourth subequal,  $1\frac{1}{2}$  in head, the others decreasing gradually, the eighth being contained less than 3 times in head; longest soft dorsal ray  $2\frac{1}{4}$  in head; anal spine evident; longest anal rays  $2\frac{3}{4}$  in head; pectorals  $1\frac{1}{4}$  in head, reaching posterior edge of spinous dorsal; ventrals equal the pectorals. Scales large, ctenoid; head well scaled, there being three scales upon the maxillary bone, a row of six upon the cheek, and an odd one on its lower margin; preopercle and opercle with about two rows each; preorbital without scales, but roughened by a very evident

set of irregularly radiating lines, thus, ; the branches of the pores in the scales of the lateral line are large and numerous, as many as thirteen being counted in some scales. Teeth villiform, in a band broadest in front and narrowing backward. Gillrakers slender, the longest  $3\frac{1}{2}$  in maxillary, about 16 below the angle. Peritoneum black.

This species is allied to *U. preorbitalis* Smith & Swain, from which it differs in the slightly shorter head, greater depth, deeper caudal peduncle, shorter maxillary, larger eye, wider interorbital, much narrower preorbital, longer ventrals, slightly longer pectorals, the outline of the spinous dorsal, the more numerous scales, and in not having the lower jaw produced.

It seems to be related also to *U. vanicolensis* (Cuv. & Val.), but may be distinguished from that species by the slightly longer head, greater depth, shorter and deeper caudal peduncle, much shorter maxillary, larger eye, narrower interorbital, slightly longer snout, smaller scales, and in having the ventral line straight.

One specimen 194 millimetres in total length. We have named this species for Prof. Richard Rathbun, assistant in charge of scientific inquiry, U. S. Fish Commission.

77. *Bairdiella icistia* (Jordan & Gilbert).

*Sciæna icistia* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 356 (*Mazatlan*).

For synonymy, see Jordan & Eigenmann, A Review of the *Sciænidae* of America and Europe, Report of the U. S. Comm. of Fish and Fisheries, for 1886, 1889.

Numerous specimens were obtained.

78. *Micropogon ectenes* Jordan & Gilbert.

*Micropogon ectenes* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 355 (*Mazatlan*); Bull. U. S. Fish Comm. 1882, 107 (*Mazatlan*); Jordan & Eigenmann, Review of the *Sciænidae* of Am. and Eur., Report U. S. Comm. Fish and Fisheries for 1886, 1889.

Five specimens were obtained.

79. *Umbrina xanti* Gill.

*Umbrina xanti* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 257 (*Cape San Lucas*).

For synonymy, see Jordan & Eigenmann, *op. cit.*, 420, 421, 423.

One specimen, 280 millimetres in length, was taken.

D. XI-29; A. II-7. Scales, 6-50-10.

Depth, 3.4 (4.2); head, 3.5 (4.3); eye in head, 4.6; snout, 3.25.

80. *Cynoscion parvipinnis* Ayres.

*Cynoscion parvipinnis* Ayres, Proc. Cal. Acad. Nat. Sci. 1861, 156.

For synonymy, see Jordan & Eigenmann, *op. cit.*, 354, 369.

Three specimens of this fish were preserved. It is common in the bay and has a good reputation as a food fish.

81. *Gerres lineatus* (Humboldt).82. *Gerres gracilis* (Gill).

Each of the above species of *Gerres* was found to be abundant at Guaymas, and, to our surprise, of the eight or ten species of this genus reported from the Pacific coast of America, these two are the only ones seen by us.

For full synonymy and analysis of the species of *Gerres* found in American waters, *vide* Evermann & Meek, Proc. Acad. Nat. Sci. Phila. 1886, pp. 256-272.

83. *Harpe diplotænia* Gill.

*Harpe diplotænia* Gill, and

*Harpe pectoralis* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 141 (*Cape San Lucas*).

*Bodianus pectoralis*, Jordan, Proc. U. S. Nat. Mus. 1885, 384; Jordan, Cat. Fish. N. A., 1895, 97.

A single specimen was obtained, which gives the following measurements:

	mm.
Length to the tip of the middle caudal rays.....	370
Length to the base of the middle caudal rays.....	320

Head (107 millimetres) equals the depth, each being 3 in length to base of caudal.

Eye (16 millimetres) 6.7 in head.

Prolonged caudal 90 millimetres in length, and is contained  $1\frac{1}{2}$  times in head. Height of dorsal rays, 81 millimetres; of anal rays, 115 millimetres.

D. XII-11; A. III-13; scales 5-34-12.

It seems certain that *H. diplotænia* is the female and *H. pectoralis* the male.

#### 84. *Pseudojulis venustus* Jenkins & Evermann.

##### PLATE II.

*Pseudojulis venustus* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 145 (Guaymas).

Not common.

#### 85. *Glyphisodon saxatilis* (L.).

Seven specimens from Guaymas, where it is not uncommon.

#### 86. *Chætodipterus zonatus* (Girard).

##### Barbero.

*Ephippus zonatus* Girard, U. S. Pacific R. R. Exp., Zool., 1858, 110 (San Diego).

*Chætodipterus faber* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 48; Goode & Bean, Proc. U. S. Nat. Mus. 1882, 238; Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 108, 111 (Panama; Mazatlan); Jordan, Cat. Fish. N. A., 1885, 102.

D., VIII-I, 23; A., III-16-18; scales about 90; dorsal spine 0.77 of head.

Two specimens,  $4\frac{1}{2}$  and 6 inches in total length respectively.

#### 87. *Chætodon humeralis* Günther.

*Chætodon humeralis* Günther, Cat. Fishes, II, 19, 1860 (Sandwich Islands?); Günther, Fishes Centr. Am., 419, Pl. 65, Fig. 3, 1866 (Panama; Guatemala?); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 108 (Mazatlan), 111 (Panama); Jordan, Cat. Fishes N. A., 102, 1885 (name only); Jordan, Proc. U. S. Nat. Mus. 1885, 385 (Mazatlan; Panama); Eigenmann & Horning, Ann. N. Y. Acad. Sci. IV, 1887, 1 (Colima).

Many specimens were obtained.

#### 88. *Pomacanthus zonipectus* (Gill).

*Pomacanthodes zonipectus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 244 (San Salvador); *ibid.*, 1863, 162 (west coast of Central America).

*Pomacanthus zonipectus*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 376 (Nicaragua; San Salvador); Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 108 (Mazatlan), 111 (Panama); Jordan, Proc. U. S. Nat. Mus. 1885, 386 (Mazatlan; Panama); Jordan, Cat. Fishes N. A., 103, 1885.

*Pomacanthus crescentalis*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 358 (Mazatlan; Panama.) (young).

*Pomacanthus zonipectus*, Günther, Fishes Centr. Am., 419, 1864 (San Salvador).

The only specimen we obtained, 110 millimetres long, is between the young (which was described by Jordan & Gilbert as *P. crescentalis*) and the adult *zonipectus*.

89. *Gobius sagittula* (Günther).*Ectenogobius sagittula* Günther, Proc. Zool. Soc. London 1861, 3.

For synonymy, see Jordan &amp; Eigenmann, Proc. U. S. Nat. Mus. 1886, 497.

Numerous specimens were taken.

90. *Gobius chiquita* Jenkins & Evermann.*Gobius chiquita* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 146. (*Guaymas*.)

Common.

91. *Gobius longicaudus* Jenkins & Evermann.*Gobius longicaudus* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 146. (*Guaymas*.)

Abundant.

92. *Gillichthys y-cauda* Jenkins & Evermann.*Gillichthys y-cauda* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 147. (*Guaymas*.)Gilbert, Proc. U. S. Nat. Mus. 1889, 363. (*San Diego, Cal.*)

Very abundant.

93. *Gillichthys guaymasiæ* Jenkins & Evermann.*Gillichthys guaymasiæ* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 148. (*Guaymas*.)

In the Proceedings of the U. S. National Museum for 1889, 363, Dr. Gilbert raises the question regarding the validity of this species as distinct from *G. y-cauda*. We have reëxamined our specimens of each species, and have compared them with specimens of what we regard as *G. guaymasiæ* collected by Dr. Gilbert.

It is evident that the two species are very closely related and probably they should be combined. The following differences, however, seem to be constant:

*G. y-cauda* has a shorter head, more pointed snout, and larger eye. The pattern of coloration of the two seems about the same, but the white spots or blotches are more pronounced in *G. guaymasiæ*, while in *G. y-cauda* the black spots on the back are more prominent, and there is a series of black spots along the middle of the side which does not appear in the other species.

Putting the differences in tabular form we have the following:

	<i>G. y-cauda</i>	<i>G. guaymasiæ</i>
Head in length .....	3½ (4) .....	3 (3½) .....
Snout .....	More pointed.	More blunt.
Eye in head .....	Larger, 3 to 4.	Smaller, 4 to 5.
Color .....	Darker.	Lighter.

94. *Gillichthys mirabilis* Cooper.

*Gillichthys mirabilis* Cooper, Proc. Cal. Acad. Nat. Sci. 1863, 109 (*San Diego Bay*); Lockington, Am. Naturalist, 1877, 474 (*San Francisco Bay*; *Gulf of California*). For full synonymy, *vide* Jordan & Eigenmann, Proc. U. S. Nat. Mus. 1886, 510.

Probably common, though we obtained but six specimens.

Dr. Gilbert has examined the types of *Gobius townsendi*, recently described by Eigenmann & Eigenmann (Proc. U. S. Nat. Mus. 1888, 463), from San Diego, and finds them to be the young of *Gillichthys mirabilis*.

95. *Gobiosoma histrio* Jordan.

*Gobiosoma histrio* Jordan, Proc. U. S. Nat. Mus. 1884, 260 (*Guaymas*); Jordan, Cat. Fishes N. A., 106, 1885 (name only); Jordan, Proc. U. S. Nat. Mus. 1885, 387; (name only); Jordan & Eigenmann, Proc. U. S. Nat. Mus. 1886, 506 and 508.

Two specimens of this interesting species were obtained. They measure 39 and 47 millimetres in total length and agree well with the original description.

96. *Scorpaena plumieri* Bloch.

Five specimens of this fish were obtained in the bay, where it is quite common.

97. *Scorpaena sonoræ* Jenkins & Evermann.

*Scorpaena sonoræ* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 150 (*Guaymas*).

One small specimen obtained.

98. *Porichthys margaritatus* (Richardson).

*Batrachus margaritatus* Richardson, Voyage Sulphur, 67 (*Gulf of Fonseca*).

*Porichthys notatus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 141; U. S. Pac. R. R. Survey, 1859, 134.

*Porichthys porfessimus* Günther, Cat. Fishes N. A., III, 176 (in part); Jordan & Jony, Proc. U. S. Nat. Mus. 1881, 5; Jordan & Gilbert, *ibid.*, 65 and 274 (*Gulf of California*); Jordan & Gilbert, Synop. Fishes N. A., 751 (in part), 1882.

*Porichthys margaritatus*, Jordan & Gilbert, Synop. Fishes N. A., 985, 1882; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 626; Jordan, Proc. U. S. Nat. Mus. 1884, 41; Proc. U. S. Nat. Mus. 1885, 388; Cat. Fishes N. A., 1885, 116.

One specimen was obtained, which, compared with specimens from Santa Barbara, California, differs from them in the more slender form of the body, and in having the inside of the mouth and the gill cavities black.

99. *Gnathypops scopis* Jenkins & Evermann.

*Gnathypops scopis* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 152 (*Guaymas*).

Three specimens were taken.

100. *Opisthognathus ommata* Jenkins & Evermann.

*Opisthognathus ommata* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 153 (*Guaymas*).

Three specimens were taken.

101. *Hypsoblennius gilberti* Jordan.

*Isoethes gilberti* Jordan, Proc. U. S. Nat. Mus. 1882, 349 (*Santa Barbara*).

*Isoethes gentilis*, Jordan & Gilbert, Synopsis, 757, 1882.

*Hypsoblennius gilberti*, Jordan, Cat. Fishes N. A., 119, 1885.

The collection contains two small blennies, which we refer with some hesitation to this species. In one of them, however, there is a very dark spot upon the anterior part of the dorsal fin, while in the other it is not so dark.

Although the generic name *Hypsoblennius* was introduced by Dr. Gill without further explanation or definition than reference to a *type* (*H. hentzi*), it is probable that less confusion will be caused if Canon XLII, C. A. O., be strictly followed and *Hypsoblennius* be retained.

102. *Hypsoblennius striatus* Steindachner.

*Blennius striatus* Steindachner, Ichthyol. Beiträge v, 15, Tafel VIII, 1876 (*Panama*).

*Hypsoblennius striatus*, Jordan, Proc. U. S. Nat. Mus. 1885, 389 (name only).

Head  $3\frac{1}{2}$  (4); depth 4 (5); eye 4 to 5 in head; D. XII-17; A. 18 or 19.

The head is a little greater than the depth; the snout steep and gently curved; orbital tentacles  $1\frac{1}{2}$  to 2 times diameter of eye, usually four branches.

Dorsal fin little notched, its longest rays nearly 3 in head; anal lower, its rays  $3\frac{1}{2}$  to 4 in head; pectorals  $1\frac{1}{2}$  in head, just reaching anal.

Color yellowish; five quadrate spots of darker extending from dorsal fin to a line drawn from middle of eye to lower base of caudal, the anterior one above tip of pectoral; median line of side with a more or less distinct series of small spots; a short dark vertical line behind the eye; a dark blotch in front of origin of dorsal fin, and another on the humeral region; under side of head with two ill-defined bands of dark; dorsal fin more or less speckled with black; the anal with a narrow white border, above which is a broader band of dark brown.

Six specimens were obtained.

103. *Labrosomus xanti* Gill.

*Labrosomus xanti* Gill, Proc. Acad. Nat. Sci. Phila. 1860, 107 (*Cerro Blanco, Lower California*).

*Clinus xanti*, Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 368 (*Cape San Lucas*);

Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 108 (*Mazatlan*) (name only).

*Labrisomus nuchipinnis xanti*, Jordan, Proc. U. S. Nat. Mus. 1885, 389 (*Mazatlan*);

Jordan, Cat. Fishes N. A., 120, 1885.

One specimen, 95 millimetres in total length, was obtained.

104. *Auchenopterus asper* Jenkins & Evermann.

(Plate II.)

*Auchenopterus asper* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 154 (*Guaymas*).

Six specimens.

105. *Pseudoblennius hypacanthus* Jenkins & Evermann.

*Pseudoblennius hypacanthus* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 156 (Guaymas).

One specimen.

106. *Citharichthys gilberti* Jenkins & Evermann.

*Citharichthys gilberti* Jenkins & Evermann, Proc. U. S. Nat. Mus. 1888, 157 (Guaymas.)

*Citharichthys spilopterus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 382 (Panama); *ibid.*, 1882, 630 (Panama); Jordan & Gilbert, Bull. U. S. Fish. Comm. 1882, 108 and 111 (Mazatlan; Panama); Jordan & Gilbert, Synopsis Fishes N. A., 1882, 817 (in part; Panama); Jordan, Proc. U. S. Nat. Mus. 1885, 391 (Mazatlan; Panama); Günther, Fishes Centr. America, 1869, 471, Pl. LXXX, Fig. 2 (Chiapas). *Citharichthys sumichrasti* Jordan, A Review of the Flounders and Soles, in Ann. Report of Commr. Fish and Fisheries for 1886, bearing date 1889, 276 (Rio Zana-tenco, Chiapas; Panama).

It seems to us that Günther was wrong in identifying his west coast specimens with the east coast *Spilopterus*, and regard all Pacific coast references to *Spilopterus* as meaning the form which we have described as *C. gilberti*.

107. *Paralichthys adspersus* (Steindachner).

*Pseudorhombus adspersus* Steindachner, Ichthyol. Notizen v, 1867, 9, Tafel 2 (Chinches Islands.) Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 370 (Cape San Lucas).

But one specimen taken.

108. *Achirus mazatlanus* (Steindachner).

*Solea mazatlanana* Steindachner, Ichthyol. Notizen ix, 1869, 23, Tafel 5 (Mazatlan.)

Common; eleven specimens were obtained.

109. *Balistes polylepis* Steindachner.

*Pez de Puerco.*

*Balistes polylepis* Steindachner, Ichthyol. Beiträge v, 21, 1876 (West coast of Mexico); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 276 and 277 (Punta San Felipe; Cape San Lucas), (name only); *ibid.*, 1882, 631 (Panama) (name only). Jordan & Gilbert, Bull. U. S. Fish Comm. 1882, 108 (Mazatlan); 111 (Panama), (name only); Jordan, Proc. U. S. Nat. Mus. 1885, 392 (Panama; Mazatlan), (name only); Jordan, Cat. Fishes N. A., 140, 1885 (name only).

Head, 3 (4); depth, 2 (2.4), greater in young; eye 4 to 4½ in head. D. III-27; A. 25; scales.

Profile from snout to spinous dorsal gently arched, thence to soft dorsal nearly straight, and from there to caudal peduncle very slightly arched; under side a regular curve from snout to caudal peduncle, with slight irregularity at chin and ventral fin.

First dorsal spine long ( $1\frac{2}{3}$  in head), stout, quadrilateral in cross-section, greatly roughened upon the anterior angles; second spine less than half length of first, while the third is about one-third length of the first.

The soft dorsal is greatly produced at the second to ninth rays, the longest about  $1\frac{1}{4}$  in head; those back of the fifth gradually decrease in length and become more and more directed forward; the length of the base of the soft dorsal is greater than the head.

The first anal rays are less produced than the dorsal and are contained  $1\frac{3}{4}$  in head; the base of the anal fin is some shorter than that of the soft dorsal. Pectorals short,  $2\frac{1}{2}$  in head. Upper and lower caudal rays much produced in older specimens. Gill-slit extends from in front of the upper edge of pectoral obliquely upward and backward, its upper end being in a vertical line under the first dorsal spine. Eight teeth in each jaw, the middle pair strongest, pointed and curved, the lateral ones shorter and somewhat double pointed.

Eight specimens, ranging from 150 to 260 millimetres in total length, were obtained at Guaymas, where it is known as *Pez de Puerco* by the local fishermen.

#### 110. *Spheroides politus* Girard.

*Tetraodon politus* Girard, U. S. Pac. R. R. Expl. Ex., Fishes, 1859, 340 (*San Diego, California*).

For synonymy, see Jordan & Edwards, Proc. U. S. Nat. Mus. 1886, 235, 239.

Up to the present time only large specimens, 1 foot in length, were known. As these differ from *Spheroides testudineus annulatus* in only a few important differences, Jordan & Edwards (*loc. cit.*) express the opinion that the former may be but the adult of the latter.

We have compared our specimens with *Spheroides testudineus annulatus* of corresponding sizes, and our specimens, including those from 3 inches in length to those of 1 foot, are all *entirely smooth*, except occasionally one shows a small patch of very small prickles on the breast. The interorbital space is flat in our specimens, concave in *S. testudineus annulatus*; the small, dark, round spots on the sides are much smaller in our specimens. From these facts it would seem that *S. politus* may be regarded as a good species.

The following species have been recorded by others from the Bay of Guaymas, but were not seen by us:

1. *Myrophis vafer*. Jordan, Proc. U. S. Nat. Mus. 1884, 260 (*Emeric*).
2. *Orthopristis cantharinus*. Jordan, Proc. U. S. Nat. Mus. 1885, 379 (*Nichols*).
3. *Cynoscion othonopterus*. Jordan, Proc. U. S. Nat. Mus. 1885, 383 (*Nichols*).
4. *Cynoscion macdonaldi*. Gilbert, Proc. U. S. Nat. Mus. 1890, 64.
5. *Gerres californiensis*. Jordan, Proc. U. S. Nat. Mus. 1885, 383 (*Nichols*).
6. *Gobius saporator*. Jordan, Proc. U. S. Nat. Mus. 1884, 260 (*Emeric*).
7. *Platophrys leopardinus*. Jordan, Proc. U. S. Nat. Mus. 1884, 260 (*Emeric*); *ibid.*, 1885, 391 (*Emeric*).

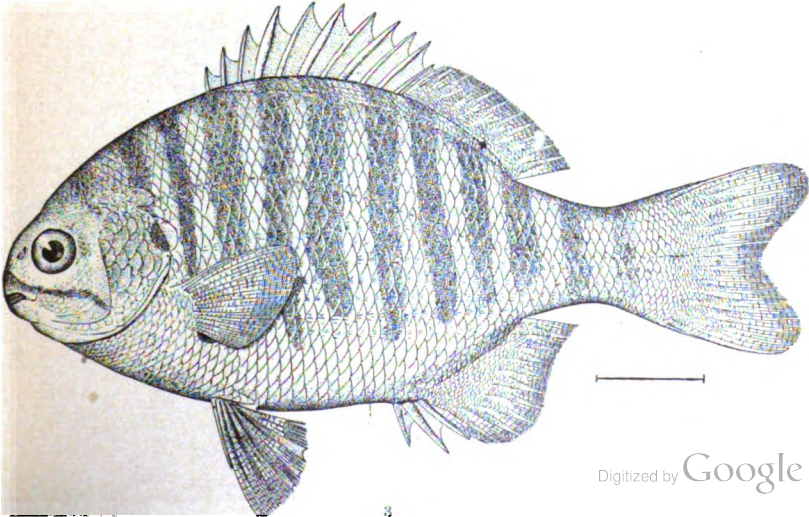
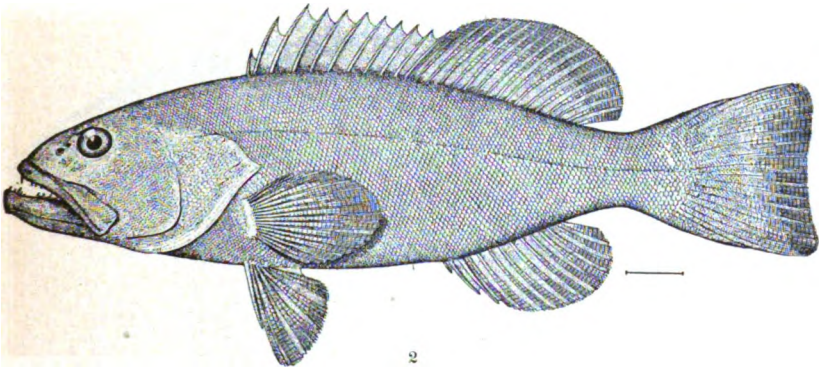
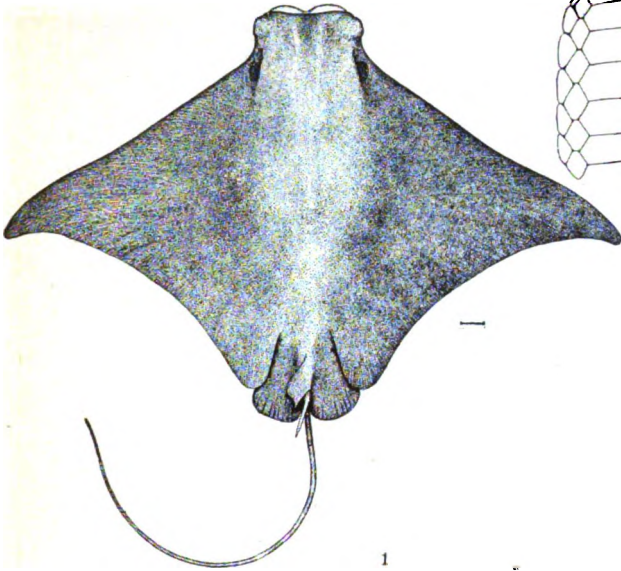
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DE PAUW UNIVERSITY, GREENCASTLE, IND.

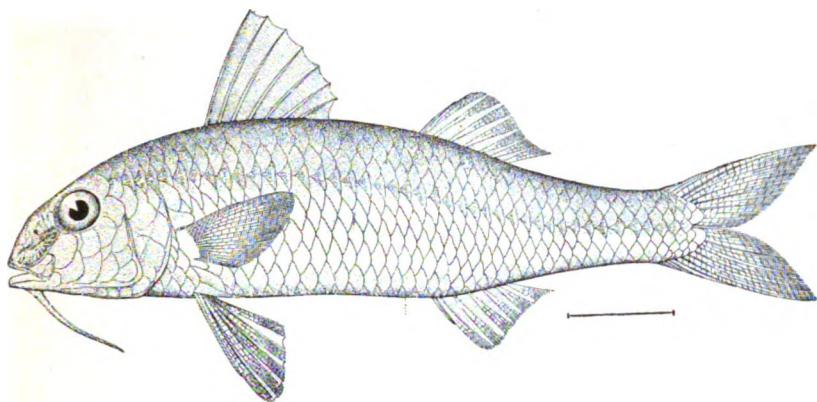
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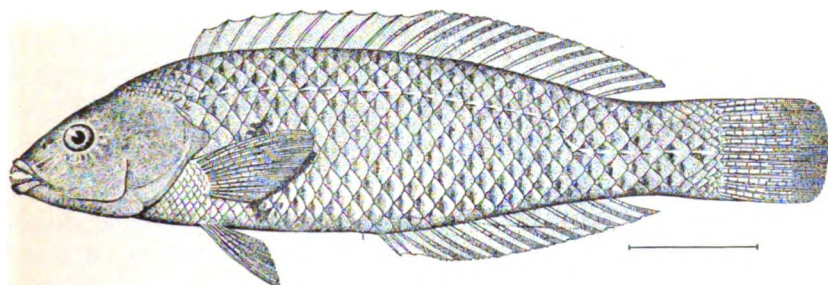




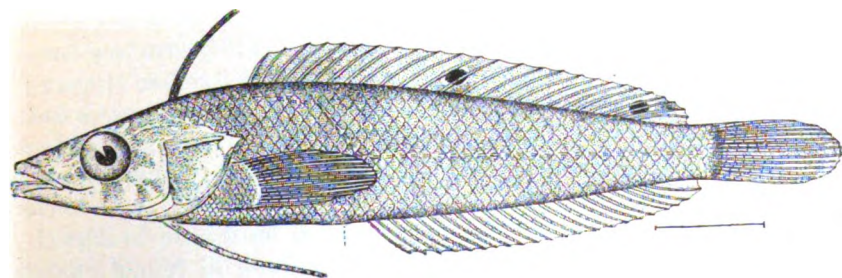




4



5



6

4. *UPENEUS RATHBUNI*.  
5. *PSEUDOJULIS VENUSTUS*.  
6. *AUCHENOPTERUS ASPER*.



DESCRIPTION OF A NEW GENUS AND SPECIES OF TAILLESS  
BATRACHIAN FROM TROPICAL AMERICA.

BY  
LEONHARD STEJNEGER AND FREDERICK C. TEST.

(With Plate III.)

**Tetraprion**, gen. nov.

(τετρας, four; πριον, saw.)

Of the family *Hylidae*: Pectoral arch arciferous; no ribs; no mandibular teeth; vertebrae procoele; sacral vertebra with dilated diapophyses and two condyles for articulation with the simple coccygeal style; terminal phalanges claw-shaped.

One long series of teeth on parasphenoid bone; vomerine teeth; a series of teeth on the palatines; head rough, bony, the skin being involved in the cranial ossification; tympanum distinct; fingers and toes webbed, the tips dilated into regular disks; outer metatarsals not bound together(?); omosternum and sternum cartilaginous; pupil horizontal(?); tongue —?

TYPE: *Tetraprion jordani*.

**Tetraprion jordani**, sp. nov.

Vomerine teeth in two well separated, nearly transverse groups situated on a level with the posterior border of the choanæ, each group consisting of about five rather large teeth; a single, transverse, slightly s-curved series of closely set small teeth on each palatine behind the choanæ; teeth on parasphenoid small, closely set, forming a long, single series; top of head bony, very rough, especially the ridges; canthus rostralis forms a prominent sharp ridge; loreal region very concave; interorbital space very wide and concave; a prominent bony supratympanic ridge; posterior border of "helmet" nearly straight, slightly concave in the middle; tympanum circular, its diameter four-sevenths of diameter of orbit; fingers one-third webbed, first nearly free, opposable; toes nearly one-half webbed; disks much smaller than tympanum; tibiotarsal articulation reaches the tympanum; skin above and on throat and chest smooth; rest of under surface granulate. Color can not be made out satisfactorily, but seems to be brownish above and uniform whitish below.

Length of head from mouth to posterior border of helmet, 21 millimetres; length of head and body, 71 millimetres; greatest width of head, 21 millimetres.

TYPE: U. S. National Museum, No. 12274.

HABITAT: Guayaquil, Ecuador.

This interesting novelty is dedicated to Dr. David S. Jordan, president of the Leland Stanford Junior University of California.

Although evidently nearly related to *Tripriion*, it differs from all known *Hylidæ* in possessing teeth on the palatines, a character which in itself seems sufficient to warrant its generic separation. With *Tripriion* and *Diaglena* it shares the possession of teeth on the parasphenoid. The latter are firmly fixed to the bone, while the palatine teeth, which form a slightly s-curved line on each side posterior to the choana, only adhere to the membrane covering the palatine bones. We are thus confronted with an entirely unique dentition, for it seems that not even in the family *Hemiphractidæ*, which is composed of genera with both palatine and parasphenoid teeth, do we find a genus in which they occur simultaneously. The presence of parasphenoid and palatine teeth in otherwise undoubtedly Hylid genera, coupled with the occurrence of claw-shaped terminal phalanges in *Ceratohyla*, makes it doubtful whether the presence of mandibular teeth in the *Amphignathodontidæ* and *Hemiphractidæ* really have the value now attributed to them as constituting a family character. That the non-dilatation of the diapophyses of the sacral vertebra in the *Hemiphractidæ* in itself is of but little consequence seems evident from the variability of this character within the family *Hylidæ*.

It is stated above that in *Tetrapriion* the outer metatarsals are not bound together. This would be an important character, but I am not sure that the very soft condition of the type is not responsible for this state of affairs.

The tongue was found removed by some accident in the hitherto unique type of this species.

Owing to the bad preservation of the specimen it is impossible to say with absolute certainty what is the shape of the pupil, but Mr. Test thinks that he once made it out to be horizontal.

The figures on the accompanying plate will illustrate and supplement the above description. It will be noted that the epicoracoid cartilages overlap considerably, and that the precoracoids and coracoids so far from being parallel, as they are said to be in the *Hemiphractidæ*, on the contrary are greatly divergent.

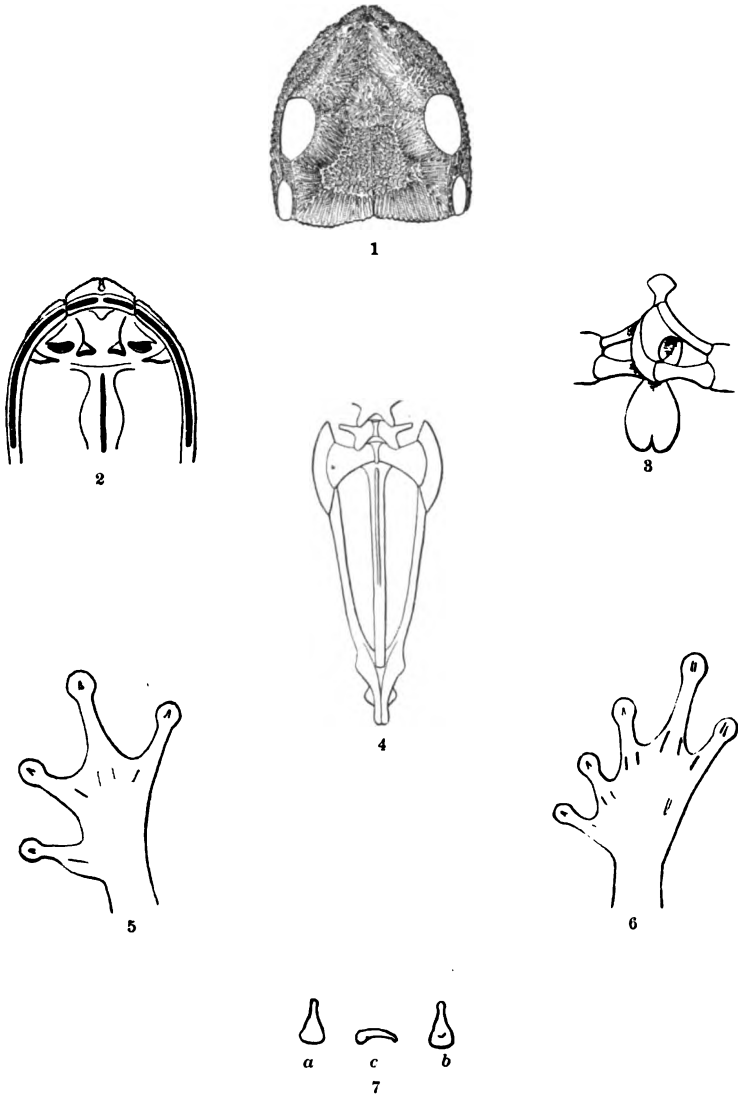
#### EXPLANATION OF PLATE III.

##### TETRAPRIION JORDANI.

Drawn by Frederick C. Test.

Fig. 1, Top of head; 2, Palate, showing dentition; 3, Pectoral arch; 4, Pelvis; 5, Dorsal view of right hand; 6, Dorsal view of right foot; 7, Distal phalanx of finger: a, dorsal view; b, ventral view; c, lateral view.

(Figs. 1-6, enlarged one-third. Fig. 7, enlarged two-thirds.)



TETRAPRION JORDANI, new genus and species.





## ON THE STRUCTURE OF THE TONGUE IN HUMMING BIRDS.

BY

FREDERIC A. LUCAS.

*Assistant Curator of the Department of Comparative Anatomy.*

(With Plate IV.)

Although it is evident from Dr. Gadow's paper on the Suctorial Apparatus of Tenuirostres\* that he is well acquainted with the structure of the tongue of Humming Birds, he merely alluded to this group, and as so much misinformation on this subject is current in ornithological literature, it is hoped that the present paper may be of service in correcting some of the many misstatements.

The paper is based on the examination of the species noted below, and it is probable that the type of tongue herein described will be found to prevail throughout at least the greater portion of the *Trochilidae*, and should exceptions exist, they will most likely be found in the *Phaethornithinae*.

### Species examined:

*Lampornis* sp.

*Eulampis holosericeus*.

*Florisuga mellivora*.

*Mellisuga minima*.

*Trochilus colubris*.

*Calypte annæ*.

*Selasphorus platycercus*.

*Selasphorus rufus*.

*Stellula calliope*.

*Doricha evelynæ*.

*Lophornis* sp.

*Bellona exilis*.

*Chlorostilbon* sp.

The tongue of Humming Birds, like that of such woodpeckers as *Colaptes* and *Hylotomus*, is extremely long, but there is little or no structural similarity between them.

In *Colaptes* the tongue is not continued beyond the anterior end of the short, fused, ceratohyals, and the basihyal is extremely long, while in *Trochilus* the greater portion of the tongue consists of the cartilaginous sheath of the ceratohyals, and the basihyal is short.

The reason for this difference is quite evident. The tongue of the woodpecker is a barbed spear, which to be effective needs to be more or less rigid. The tongue of the Humming Bird is used to entrap, not to impale, insects, and for extracting honey from flowers, and for these purposes it does not need to be especially stiff.

\* Proc. Zool. Soc. London, 1883, pp. 62-69, Pl. xvi.

Proceedings National Museum, Vol. XIV—No. 848.

In both *Colaptes* and *Trochilus* the ceratobranchials are moderate, the epibranchials extremely long.

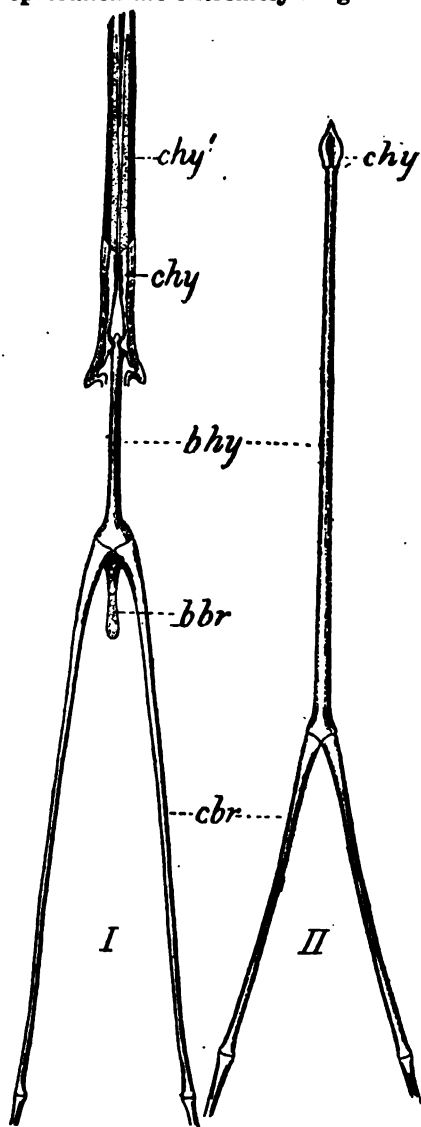


FIG. I. Hyoid of *Selasphorus rufus*  $\times 8$ . *chy'*, cartilaginous prolongation of the ceratohyals. A portion of the surrounding sheath is shown, the difference in the shading indicating where the ceratohyal sheath becomes detached; *chy*, ceratohyal; *bhy*, basihyal; *bbr*, basibranchial; *cbr*, ceratobranchial. Only the distal portions of the epibranchials are shown.

FIG. II. Hyoid of *Colaptes auratus*  $\times 2$ . Letters as before.

Basibranchial is wanting in *Colaptes*, very small and cartilaginous in *Trochilus*.

The base of the Humming Bird's tongue is formed of the soft, fatty, fibrous envelope of the basihyal, which, when the tongue is protruded, stretches like a spiral spring, and like a spiral spring contracts as the tongue is withdrawn.

As the tongue is extended the ceratobranchials are apposed and pressed forward into this fibrous sheath, and even when at rest these little bones lie close together, only separating when the tongue is convulsively retracted, as in the act of gasping.

The soft base is succeeded by the dense, cartilaginous sheath of the ceratohyals, and this practically consists of two portions, that investing the osseous part of the ceratohyals and that surrounding their cartilaginous anterior portions.

In badly preserved specimens this latter part can be slipped off intact, and its structure readily studied.

At first the cartilaginous sheath forms a single tube, somewhat elliptical in transverse section, grooved along the center above and below, and showing a slighter groove on the upper exterior surface.

The central grooves indicate the present division of the tube by a vertical partition, the lateral grooves the formation of a flange along the outer edge.

A little more than halfway between base and tip the tongue becomes forked, each division being a rod bordered by a wide flange of thin

membrane, the external fold of cartilage becoming thus transformed before the fork of the tongue is reached.

This membrane curls upward and inward, much as one might roll a piece of paper, so that toward the apex two very delicate parallel tubes are formed.

This tubular part of the tongue, formed by the curled-up membrane, exists only for a short distance towards the anterior end, so that the common statement that the tongue of the Humming Bird consists of two parallel muscular tubes is quite erroneous.

So also is the statement that the tubular part of the tongue when at rest is drawn back into a muscular sheath.

When the flange is flattened out each moiety of the tongue suggests a feather with the vane on one side only, a resemblance that is heightened by the fact that toward the anterior end the membrane is more or less fimbriated.

Just how much of this fimbriation is normal and how much due to wear is somewhat of a question, although it is very evident that use has something to do with the lancing of the membrane, for it varies in individuals of the same species, and in some cases whipping out by wear is very apparent.

Dr. Gadow, indeed, speaks of specimens in which the membrane was entire, but does not mention the species, and none have come under my own notice in which the membrane was not somewhat lanced.

The width of the bordering membrane varies in different genera, being for example very wide in *Florisuga* and very narrow in *Bellona*, the width doubtless bearing some direct relation to the food of the bird.

In a nestling of *Calypte annæ*, shown in Fig. 6, Pl. IV, the bordering membrane was longer than the cartilaginous rod supporting it, and the tongue but little cleft.

No fresh specimens of Humming Birds have been available, but in all birds examined the two branches of the tongue have more or less of an outward spiral twist, as shown in Fig. 3, Pl. IV, and I suspect that this may be the normal condition, although it is not mentioned by Gosse, who gives a very good description of the Humming Bird's tongue.

This author states that he is unable to quite understand the action of the tongue in sucking up liquids, and that while drinking sirup the tongue is protruded for half an inch or so and worked rapidly backward and forward.

Certainly there can be no sucking in the proper meaning of the word, since no vacuum can be formed at the back of the tongue, and liquids probably pass through the tubular portion by capillary attraction.

It seems probable, as stated by Professor Newton, that the chief use of the tongue is to capture small insects, and the size of the salivary glands suggests that the tongue may be covered with a viscous secretion to which minute insects would adhere, and thrust into crevices beyond the reach of the beak.

It is worthy of remark that the Golden-winged Woodpecker (*Colaptes auratus*), a species with unusually large salivary glands, employs its tongue in this manner to extract ants from their abiding places.

The principal muscles of the tongue are as follows:

*Serpio hyoideus*.—Probably owing to my lack of skill in dissection this muscle proved hard of detection, but although extremely delicate it is probably always present. It was unusually well defined in one specimen of *Selasphorus rufus*.

*Mylo hyoideus*.—Well developed, filling much more than two-thirds of the space between the rami of the jaw.

*Stylohyoideus*.—This large and important muscle arises at about the junction of the frontals with the premaxillaries, and curves around the skull external to the hyoid with its enveloping geniohyoideus.

At the angle of the jaw it turns inward, passes below the geniohyoideus, turns upward and outward to make a half turn around the epibranchial, and is continued along the outer side of this bone and the ceratobranchial to the anterior point of attachment on the upper side of the ceratobranchial.

By this peculiar half turn around the epibranchial the pull of the muscle is in a great measure transferred from the ceratobranchial to that point.

*Geniohyoideus*.—This muscle to a great extent underlies rather than envelopes the epibranchial, and it is but little twisted around this bone. As just stated, it passes above (dorsad) the stylohyoideus and becomes free from the epibranchial just where stylohyoideus passes around the epibranchial. The muscle is then continued to the symphysis of the mandible.

This arrangement of the stylo and genio hyoideus not only gives these two muscles a remarkably long pull, enabling them to act with great force, but also eases the strain on the long, slender epibranchial.

*Ceratoglossus*.—This slender muscle arises at the posterior third of the epibranchial and runs, as usual, to the basihyal.

*Tracheohyoideus*.—Although slender, this muscle is well defined, running from the upper part of the trachea, just below the arytenoid cartilage, to the basihyal.

#### EXPLANATION OF PLATE IV.

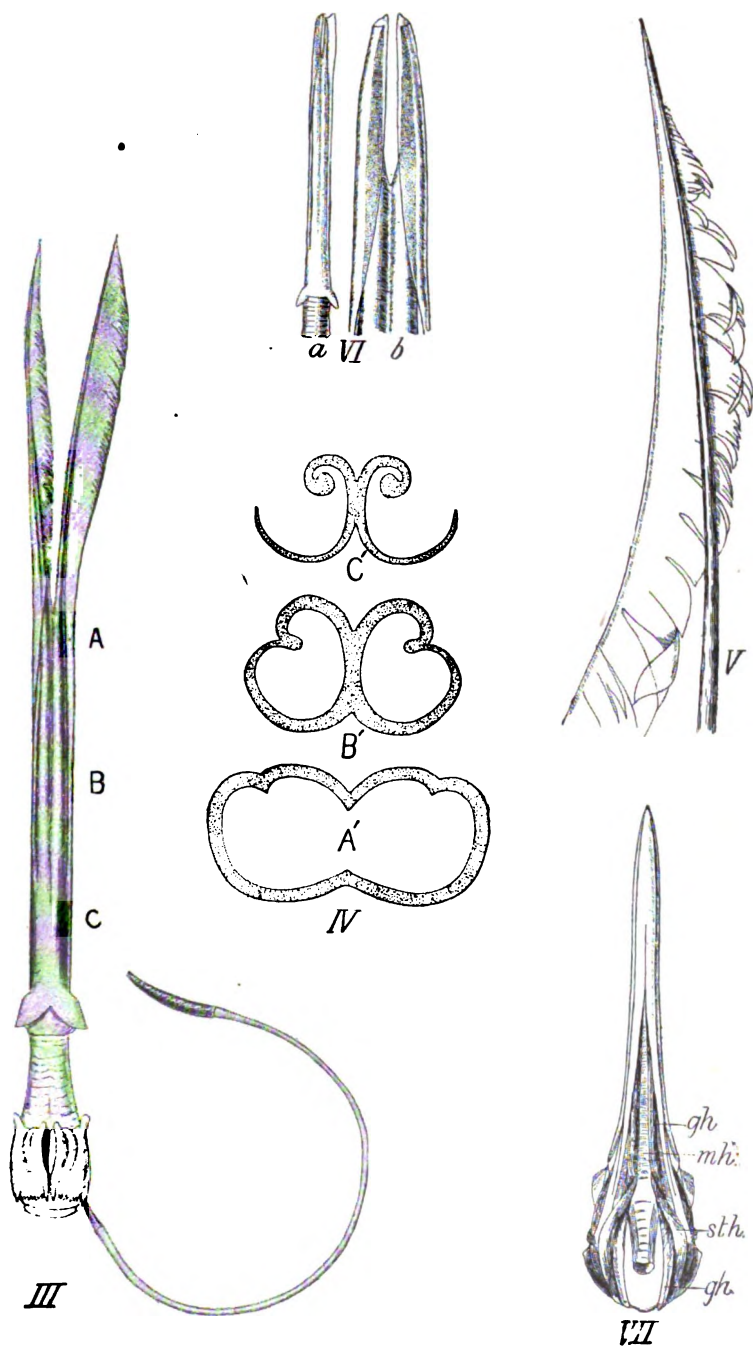
Fig. 3. Tongue of *Eulampis holosericus*, enlarged. The membrane of the right side is opened out, that of the left retains the spiral twist commonly seen.

4. AB'C', Sections through the sheath of the ceratohyals at CBA. Very greatly enlarged. From camera lucida drawings.

5. Tip of tongue of *Eulampis holosericus*, left side, from below, the membrane being flattened upon itself. Greatly enlarged. From a camera lucida drawing.

6. a, Tongue of nestling of *Calypte anna*  $\times 6$ . b, Tip of same greatly enlarged, with the membrane curled inward as in nature.

7. Head of *Eulampis holosericus* seen from below, slightly enlarged: *gh*, geniohyoideus; *mh*, mylohyoideus; *sth*, stylohyoideus.



THE TONGUE OF HUMMING BIRDS.



SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH  
COMMISSION STEAMER ALBATROSS.

[Published by permission of Hon. Marshall McDonald, Commissioner of Fisheries.]

No. XX.—ON SOME NEW OR INTERESTING WEST AMERICAN SHELLS  
OBTAINED FROM THE DREDGINGS OF THE U. S. FISH COMMISSION  
STEAMER ALBATROSS IN 1888, AND FROM OTHER SOURCES.

BY

WM. H. DALL,

*Curator Department of Mollusks, U. S. National Museum.*

(With Plates v-vii.)

Among the dredgings of the *Albatross* and other West American shells received during the last few years several forms of unusual interest have turned up, and it was thought desirable to have them described and illustrated for the use of students and collectors of the mollusks of this fauna. Some old species which have never been figured, or have been imperfectly figured, are here illustrated.

The confusion which has attended the history of some of them has been more or less successfully cleared up and distinctive features pointed out. In the absence of a complete monograph of West American species, less pretentious contributions to the knowledge of the fauna will help students to a better understanding of it, and thus advance the science and the prospect of a more comprehensive work. I have been much indebted to the kind coöperation of Mr. J. J. Rivers, of the University of California, Miss Ida M. Shepard, of Long Beach, and Mrs. M. Burton Williamson, of University, California, as well as several other ladies mentioned in the text.

Genus **EUPLEURA** Adams.

The species of this genus have been in a good deal of confusion, which I have endeavored to clear up in my contributions to the Tertiary Fauna of Florida (Transactions of the Wagner Free Institute of Science, Philadelphia, vol. III, p. 144, 1890). Numerous specimens of the Pacific form were dredged by the *Albatross* off the coast of Lower California near Cerros Island. I have thought it desirable to figure the various forms from typical examples in order to clear up the confusion.



*Eupleura muriciformis* Broderip.

(Plate v, Fig. 2.)

*Ranella muriciformis* Brod., P. Z. S., 1832, p. 179; Reeve, Conch. Icon. *Ranella*, Fig. 34.*Ranella plicata* Reeve, P. Z. S., 1844, p. 138; Conch. Icon., Fig. 33.*Ranella triquetra* Reeve, *op. cit.*, p. 139; Conch. Icon., Fig. 41, 1844.*Eupleura muriciformis* Dall, Trans. Wagner Inst. Sci., III, p. 145, 1890.

HABITAT: Montija Bay, West Columbia, Cuming *vide* Broderip; San Diego, Nuttall, *vide* Reeve; off Cerros Island, Lower California, in 10 to 16 fathoms; U. S. Fish Commission.

This species is found living in the Pacific waters from Venezuela to California and fossil in the Postpliocene of much of the same region.

*E. triquetra* Reeve is a large specimen with an unfinished lip; *E. plicata* of the same author is evidently a specimen of the same form with the canal shortened by mutilation.

I have seen no connecting links with *E. pectinata* Hinds, though they may exist. *E. nitida* Broderip is an entirely distinct species.

There are three varieties in the recent material belonging to this species which I have examined. The adult typical *muriciformis* has the following characters:

On the last whorl there are three strong knobs between the varices on each side; there is a thin, webbed varix with six primary spines, all recurved and deeply grooved in front; within the aperture there is a dentiform callus on the outer lip between every pair of spines and one on each side of the sutural commissure; the spine at the shoulder is much the longest, but the second spine, counting forward, is the one corresponding to the axis of the intervarical nodes; the web between the shoulder spine and the suture is bent forward; the spirals corresponding to the spines are very coarse, but not much elevated, and become stronger anteriorly as the spines diminish in strength and length.

The shell averages 37.4 millimetres in length, 23.5 millimetres in breadth, with a lesser diameter of about 12.2 millimetres.

*Eupleura* (var ?) *unispinosa* Dall.

(Plate VI, Fig. 5.)

*Eupleura muriciformis* Brod., var. *unispinosa* Dall, Trans. Wagn. Inst., III, p. 146, 1890.

This variety was collected by Rich at Mazatlan. It has a thick varix, hardly webbed, with only one short, recurved spine, which is at the shoulder; a much recurved canal; a subtriangular section; and, owing to the absence of webbing and spines, appears especially slender. This is the form which in my report on the Blake Gastropods (A, p. 203) was contrasted with the typical *E. caudata*.

The specimen figured has a total length of 33.3 millimetres, a maximum breadth of 16, and a sectional lesser diameter of 13 millimetres. This form is quite thick compared with the type and perhaps should be regarded as a distinct species, but these forms are so variable that I hesitate to separate them.

*Eupleura*, var. *limata* Dall.

*Eupleura muriciformis* Brod., var. *limata* Dall, *op. cit.*, p. 146, 1890.

At the head of the Gulf of California, near the estuary of the Colorado River, is found, both recent and in the Postpliocene of the vicinity, a variety which I have called *limata*, in which the intervarical nodes are obsolete; the whole surface nearly smooth; there are but two or three varices in all, and they are narrow and not prominent. This variety reaches a length of 40 and a width of 18.5 millimetres.

The depauperate character of this variety is very probably due to the freshening of the water by the outflow from the river and the barren sandy shore upon which it lives. I have shown elsewhere in connection with *Melongenella* that the rocky oyster reefs furnish the rough and the sandy shores the smoother specimens and this generalization probably affects most canaliferous Gastropods.

*Eupleura caudata* Say.

(Plate VI, Fig. 2.)

*Ranella caudata* Say, Journ. Acad. Nat. Sci. Phil., II, p. 236, 1822.

*Eupleura muriciformis* Tryon, Man., II, p. 158, *ex parte*, non Broderip.

*Eupleura caudata* Stimpson, An. Journ. Conch., I, p. 58, Pl. 8, Fig. 5, 1865; Dall, Bull. 37, U. S. Nat. Mus., p. 120, Pl. 50, Fig. 11, 1889; Trans. Wagner Inst., III, p. 144, 1890.

*Eupleura "clathrata" Gray* Calkins, Proc. Davenport Acad. Sci., 1878, p. 234.

HABITAT: Atlantic coast of the United States from Cape Cod to the Florida Keys, U. S. Fish Commission. Fossil in the Pliocene of South Carolina and Florida and the Postpliocene of most of the Atlantic coast.

The shell sometimes reaches a length of 27 to 30 millimetres.

The specimen figured measures 23.3 long, 12.5 wide, and 8.5 millimetres in lesser sectional diameter, taken from one side of the last whorl to the opposite side at right angles to the plane of the aperture and vertical to the intervarical dorsal node.

This species has been much confused, and the group to which it belongs, though containing but few species, presents as pretty a series of modifications in space and time as any evolutionist could wish to see. Exclusive of *E. pectinata*, of which I have only seen figures, and *Ranella pulchra* Gray, which belongs elsewhere, I recognize among the recent forms one well-established species on the Atlantic coast, with a subspecies or geographical race on the Gulf coast and some of the northern Antilles. On the Pacific coast we have two species, one of which is constant and well marked (the *E. nitida* Broderip), the other very variable and possessing a number of varieties which may be geographical or simply mutations, we are not yet in a position to decide which. *E. muriciformis* Broderip, which is the oldest name for the latter, has been referred to an unfigured "*Ranella clathrata*" of Gray, from the Atlantic, which is not only a more modern name than Broderip's, but the characters given for it are not compatible with the Pacific shell.

Although Say's name was published in 1822, it has been referred to this alleged *E. clathrata* Gray (1839) as a synonym!

The Atlantic form, the typical *caudata*, is found on the Atlantic coast from Cape Cod to the Florida Keys, and it is recognizable when adult by its smaller size, more cancellated sculpture, and by having five transverse riblets on the back of the last whorl between the two varices, and three in front. This is the form figured by Say, and which must retain the specific name. It is also fossil in the Postpliocene, if not also in the Pliocene, of the greater part of the Atlantic coast.

*Eupleura caudata*, var. *sulcidentata* Dall.

(Plate v, Fig. 4.)

*Eupleura caudata*, var. *sulcidentata* Dall, Trans. Wagn. Inst., III, p. 147, 1890.

Gulf coasts of the United States and the Florida Keys; Charlotte Harbor, in shallow water among algæ, Dall. Coast of Cuba, Gundlach.

The form figured in the Pliocene fossils of South Carolina by Tuomey and Holmes is the typical *caudata*, as is that of the South Carolinian Postpliocene. Calkins's specimens were young and looked much like the young of the Pacific coast species. The Pliocene fossils tend toward an intermediate character, as might be expected. I have seen no genuine *caudata* from the Miocene, though the shell figured by Emmons looks as if it was this species.

This variety is characterized by its thinner, more expanded, and recurved varices; its generally whiter color, larger size; and has in the adult, on the back, three intervarical, flattish, transverse ribs and two or three in front. The spire is rather more elevated than in the typical *caudata*, and, except on the varices, the spiral threads are often absent or obsolete. Young shells have more intervarical ribs than adults. In the American Marine Conchology Mr. Tryon, by some oversight, refers to the synonymy of *E. caudata* a *Fusus pyruloides* of De Kay, which appears to have been founded on an immature *Melongenæ*. It is possible he meant to write *Fusus imbricatus* De Kay, which is described on the same page as the other, and figured on the same plate. This figure somewhat resembles a young *Eupleura*, but from the description one would be disposed rather to refer it to an immature *Urosalpinx*.

This is the southern race of *E. caudata*, readily distinguished from the latter by its usually pure white and less earthy shell, its more sloping spire, less angulated varices, and the sulci between the teeth of the aperture. It has a smoother, less reticulated shell, with the spiral sculpture obsolete, usually few intervarical sharp transverse ridges, and the spines at the shoulder absent or less pronounced. The throat is often purple or brown, against which the white teeth of the outer lip show prettily. It has not been found north of Florida on the Atlantic coast. It frequently reaches a larger size (25 millimetres) than the specimen figured, which measures 19 millimetres long, 10 millimetres wide, and a lesser diameter on the section of the last whorl of 6 millimetres.

This is the form which has, especially in large worn specimens from the Keys, been most frequently mistaken for *E. muriciformis*, the young of which it somewhat resembles.

*Nassa californiana* Conrad.

*Schizopyga californiana* Conrad, Proc. Acad. Nat. Sci. Phila., 1856 (Dec.), p. 315; Pacific R. R. Reports, vol. VI, p. 69, Pl. 2, Fig. 1, 1857; Cpr. Suppl. Rep. Br. Assoc., 1858, p. 593.

*Nassa* (*Cassia*) *fossata* Gabb, Pal. Cal., II, pp. 47, 74, 1859; *ex parte*, not of Gould.

*Schizopyga californica* Gabb, *op. cit.*, p. 74, in synonymy; not of Conrad.

Miocene of Santa Clara County, California; Conrad. Dead Man's Island, near Long Beach, California; Miss S. P. Monks, Hon. Delos Arnold, and Mrs. M. Burton Williamson. Recent on the coast of California from Drake's Bay to Cerros Island, in 25-65 fms. U. S. Fish Com.

This is a typical *Nassa*, of the evenly reticulate kind, and doubtless the ancestor of *N. fossata* Gould, from which it differs by its more slender and cylindric form, its more evenly reticulate sculpture, and its less pronounced varix at maturity. It has much the sculpture and general form of *N. perpinguis*, with the size and strength of *N. fossata*, with the latter of which it has been injudiciously united by Gabb. The "genus" *Schizopyga* was based on the postsiphonal sulcus common to all species of *Nassa* and described from an imperfect and mutilated specimen. It has of course no claims to present consideration.

*Fusus Kobelti* Dall.

(Plate VI, Fig. 4.)

*Fusus Kobelti* Dall, On the California species of *Fusus*, Proc. Cal. Acad. Sci., Mar., 1877. Extra copies Mar. 19, 1877.

HABITAT: Monterey to San Diego, California; off Catalina Island, in 16 fathoms; U. S. Fish Commission.

Shell elegantly and regularly fusiform, of seven or eight whorls, sculptured with revolving lines and transverse costæ. In young specimens the whorls are somewhat rounded, in the adult elongated. Epidermis in perfect specimens dark ashy or greenish olivaceous, rising in crowded lamellæ and obscuring the coloration. This varies, however, with age and habitat. Apex acute, the second and third whorls hardly larger than the embryo. Color whitish, the alternate revolving ridges of a dark brown, which occasionally extends to all the ridges. These ridges do not lose their color in passing over the costæ, except where worn off by rolling on the beach. Except on the earlier whorls the ridges do not show any tendency to enlarge in passing over the costæ. On the posterior edge of the whorls the shell is appressed on the suture, and the ridges here are inconspicuous in most specimens, compared with those on the body of the whorl. These ridges, moreover, bear the character of threads, the interspaces not being channeled, as in *F. Harfordi* and *luteopictus*. In the most perfect specimen, on the

last whorl there are twenty-two brown ridges and as many more intercalary, of the same color as the shell. In melanitic specimens all may be tinged brown. On the antepenultimate whorl between the sutures there are about six main ridges and eight intercalary. The costæ are rounded and prominent only on the earlier whorls, but they remain on the last whorl in a flattened condition, but extend well over the periphery, and are not obsolescent as in the last species. The interior of the aperture is white. Before the lips are thickened the brown lines show through, and the prominent white threads of the throat are distant from the outer edge. In this stage there is no siphonal fasciole. Later both lips may be strongly thickened; the threads (ten or fifteen in number) nearly reach the edge; a labial callus and fasciole are formed. In adults there are about twelve costæ on the last and ten on the sixth whorl.

This species may reach 2 inches in length. A specimen perfect, but with the lip still unthickened, measures 49 millimetres long; spire, 24 millimetres; aperture, 15 millimetres (to posterior notch); canal, 12.5 millimetres. The total is more than the total length, not being measured on a median line.

This beautiful species appears to be very rare in a perfect condition, though rolled specimens are common on Catalina Island (northern) beaches and at San Pedro. The features of a young living specimen from Monterey are obscured by the shaggy epidermis, of which beach specimens show no trace whatever. In much thickened specimens there is a lump on the whorl at the posterior angle of the aperture. It is perfectly distinct from the other Californian species and from any I find figured in the monographs. In a general way it is perhaps a little like *F. ustulatus* Reeve (Conch. Icon., Pl. XVII, Fig. 66). It was named in honor of Dr. W. Kobelt, of Frankfort on the Main, who has prepared a monograph of the genus.

***Fusus* (*Chrysodomus* ?) *Harfordi* Stearns.**

(Plate VI, Fig. 6.)

*Fusus Harfordi* Stearns, Prel. Descr., Aug., 1871, Proc. Cal. Acad. Sci., v, p. 79, 1873; Dall, Extr. Proc. Cal. Acad. Sci., Mar. 19, 1877.

**HABITAT:** Mendocino County, California; Harford. Farallones Islands, off San Francisco Bay; Watkins.

*Fusus cinnamomeus* Rve. (Conch. Ic., 16) presents some resemblance to this species, which differs from the former in having a shorter canal, a longer spire, more rounded whorls and much deeper sutures; more numerous revolving ridges, which are also narrower; and especially in the presence of strongly marked, beautifully rounded costæ, which become obsolete next the suture and on the last whorl. These costæ recall those on the upper whorls in decorticated *Priene oregonensis*, but are not cancellated. They reach across the whorls in the young shell, fading out anteriorly as it approaches the adult condition. In young

shells the epidermis is usually polished and of a bright ruddy brown; in an adult it is raised between the revolving ridges into successive lamellæ, which indicate that a fresh and perfect specimen must present a pubescent appearance, verging on shagginess. The interspaces in the posterior whorls are about as wide as the revolving ridges, but on the last whorl smaller intercalary ridges appear, especially on the anterior half of the whorl. There is a tendency to a smoothish space on each side of the suture, which gives it a channeled appearance. Excluding the nuclear portion, there are about five ridges on the first five whorls. On the fifth there are about ten costæ. On the last whorl of the adult, the costæ being evanescent, there are about seventeen main ridges and ten or eleven intercalary threads. The spire is a little longer than the length of the aperture plus the canal. In the interior of the aperture (which is white), besides the grooves due to the external ridges, there are numerous very fine incised striæ, not quite reaching the margin, and a rather strong groove at the junction of this whorl with the last. There is no siphonal fasciole. Length, 56 millimetres. I have little doubt that this is the shell called by Middendorf *Tritonium Sabini*, from Kenai; at least, there is no other shell of the coast resembling Gray's *Fusus Sabini*. As this species has never been figured, I take this opportunity of illustrating it. The types are in the National Museum collection.

*Fusus corpulentus* Conrad.

*Fusus corpulentus* Conrad, Geol. of the U. S. Expl. Exp., p. 728, Pl. 20, Fig. 4, 1849.

*Priscofusus corpulentus* Conrad, Am. Journ. Conch., 1865, p. 150.

In a nodule of Miocene sandstone from Astoria, Oregon.

The type is still preserved in the national collection, though at one time thought to be lost. Specimens probably of this species have been obtained from the Miocene of Dead Man's Island, near Long Beach, San Pedro, California. The original type is merely an internal cast, and certain identification is impossible. The species is a true *Fusus*, with fine spiral ridges and occasional faint transverse riblets on the upper whorls. It resembles very much the *Fusus Burnsi* Dall, from the Miocene of Petersburg, Virginia, but I regard the two as distinct species. Specimens have been sent for examination from California by Miss Sarah P. Monks and Mrs. M. Burton Williamson, who obtained them from Dead Man's Island. *Fusus geniculus* of Conrad, described at the same time from an imperfect cast, is wholly unidentifiable. There are three species of *Fusus* described from the Santa Barbara Tertiary by Trask in the Proc. Cal. Acad. Sciences, I. p. 42, 1885; of which *F. Barbarensis* and *F. robustus* seem identifiable with living forms from that region, but the subject requires further study.

**Trophon triangulatus** Carpenter.

(Plate v, Figs. 1, 3, 6.)

*Trophon triangulatus* Cpr., Suppl. Rep. Brit. Assoc., p. 663, 1863; Proc. Cal. Acad. Sci., III, p. 224, Feb., 1866.

Shell large and strong, having much the texture and general aspect of *Chorus Belcheri*, purplish brown, or nearly the color of *Chrysodomus liratus*; whorls about seven, the nucleus lost; varices six to the whorl, strong, wide, thin edged, with guttered spines, which have their hinder edge rounded; surface with strongly marked lines of growth and half obsolete fine irregular spiral scratches, strongest on the body and almost wholly wanting between the suture and the spines. The interior of the mouth is polished and white or purplish. The specimen under consideration, at a point within the aperture corresponding to the position of the penultimate varix, shows faint indications of short ridges to the number of eight in front of the spine, which look as if that part of the margin of the aperture might in some specimens be denticulate. The specimen measures 75 millimetres long by a maximum diameter (including the spines) of 50 millimetres. The aperture is 56 millimetres long, inclusive of the open canal, and has a maximum width of 18 millimetres. The siphonal fasciole is strong, with a well marked chink next to it.

This remarkable shell recalls *Chorus Belcheri*, from which it differs in the more triangular shape, fewer varices, less rounded body whorl, in the absence of the basal groove and tooth characteristic of *Chorus*, and probably in the structure of the operculum, which has not yet been observed. It is, of course, a considerably smaller shell than *C. Belcheri*. The first specimens were dredged by Dr. Cooper in 90 fathoms, near Catalina Island. The description was drawn up from these, though they were less than half an inch long, and were subsequently generally suspected of being the young of *Chorus Belcheri*. The present specimen, forwarded for determination by Miss Ida Shepard, of Long Beach, California, for the first time enables one to describe the adult characters of the perfect shell and establish its distinctness as a species. It was collected on the sand at Long Beach by Miss L. E. Hale, of Pasadena, and contained the soft parts when found. Miss Hale very generously allowed her "find" to come into the possession of the Museum, where it is registered as No. 120,099.

A second specimen from Long Beach, California, belonging to Mrs. Trowbridge, is younger and somewhat worn. Longitude of shell, 61 millimetres; maximum latitude at spines, 40 millimetres; maximum latitude of body, 27.5 millimetres; longitude of aperture, 44 millimetres; longitude of longest spine, 15 millimetres. This specimen resembles the first in color, texture, etc., but shows an obscure pale band near the suture. It has six spines to each whorl. The apex is defective, but what remains shows the existence of four whorls in the specimen, with possibly one or two more in the nucleus. The interior of the aperture

is livid brown and white, the inner lip in the anterior third of the canal is erect and separate from the siphonal fasciole. It was kindly lent by the owner for inspection.

We are indebted to Mr. J. J. Rivers, curator of the biological collection of the University of California, for the opportunity of examining and figuring the original type specimen of *Trophon triangulatus* in order to complete our account of the species. This young shell differs from the adult in its whitish color, and in having one or two more varices to the whorl. The proportional length, as in all young *Trophons*, between the spire and the last whorl differs somewhat from the adult. The specimen contains the operculum, which is yellowish, subtranslucent, and apically pointed like that of *Chrysodomus*. It measures 11.5 by 6.3 millimetres. The nucleus is small, smooth, and of two whorls. It resembles the young of *T. Gunneri*, but has a shorter and acuter spire and narrower canal. It is represented by figure 3 on plate V.

*Trophon cerrosensis*, sp. nov.

(Plate V, Figs. 5, 7.)

**HABITAT:** Off Cerros Island, Lower California, in 12 to 48 fathoms, mud and sand, at Stations 2831 and 2834; U. S. Fish Commission.

Shell of moderate size, thin, elongate, with seven whorls and eight to ten sharp, thin, elevated varices, each produced into a sharp, recurved, guttered spine at the shoulder; color, white to straw color, with blushes of warm brown; transverse sculpture of fine lines of growth; spiral sculpture of low, rounded bands, with narrower interspaces, which faintly crenulate the varices and outer lip; behind the shoulder these are absent; nucleus small, translucent, smooth, and polished, of one and a half whorls; subsequent whorls flattened behind the shoulder, slightly constricted at the base; canal rather long and wide, flexuous, with a marked fasciole; lip thin, pillar with a moderate whitish callus; throat white, without liræ; operculum dark brown, rather rounded. Longitude of shell, 38; maximum latitude, 25; maximum diameter of aperture, 9 millimetres.

This beautiful form most resembles the young of *Chorus Belcheri*, which is much more solid, with fewer varices, and strongly reticulately sculptured. The figure of *T. cerrosensis*, given herewith, is turned so that the aperture is obliquely presented, so as to show the arch of the pillar; if it had been given in full front view the aperture would have seemed more rounded and wider.

This seems to belong to the same group as *T. triangulatus*, but is a much smaller and more delicate species. A marked characteristic is the difference of sculpture between the part of the whorl in front of and that behind the shoulder.



*Cancellaria Crawfordiana*, sp. nov.

(Plate VI, Fig. 1.)

Shell elongated, slender, with six moderately rounded whorls, reticulately sculptured and covered when fresh with a rather coarse brown fibrous epidermis; whorls transversely sculptured with from fourteen to twenty narrow, clear-cut, moderately elevated, even, slightly flexuous ribs, crossing the whorls, but less prominent anteriorly and separated by wider interspaces. The only other transverse sculpture is of lines of growth; spiral sculpture of (between the sutures nine to ten) narrow, flat topped, strap-like elevated cinguli, with wider excavated interspaces, rather uniformly spread over the whorl, but more distant near the shoulder, and on the earlier whorls somewhat sharper and relatively more prominent. Between the cinguli, and rarely on them, are a few obscure, revolving lines. On the canal the cinguli become rounded, smaller, and obscure. The surface under the dehiscent epidermis is polished pale brown, with a somewhat chalky substratum easily eroded. The upper whorl or two have lost most of this layer in the specimen figured and the nucleus is lost. The suture is deep, but not channeled. The canal has no constriction behind it. The aperture is rather long, the outer lip but slightly reflected and a little fluted by the spiral sculpture. Inside there are a few faint and obscure liræ. The throat is pure white; the thin body callus, tinged with pale pinkish brown. The anterior angle of the aperture is nearly canaliculate, and produces a perceptible siphonal fasciole. The pillar is straight and strong, with two plaits; the posterior stronger, both oblique and rather low. The angular edge of the pillar, though not elevated, might by some be taken as an obscure third plait. At the end of the plaits on the callus of the pillar are a number of small shelly pustules like those on *C. cassidiformis*.) Longitude of shell 43; maximum latitude 21 millimetres.

**HABITAT:** Drake's Bay, near San Francisco, California; dredged alive by Mr. J. S. Arnheim, in 24 fathoms. Also by the U. S. Fish Commission steamer *Albatross* at various points between San Diego and San Francisco, in 20-30 fathoms.

We are again indebted to Mr. J. J. Rivers, of the University of California, for the opportunity of figuring and describing this fine large shell, which forms an interesting addition to the mollusk fauna of Alta California. It belongs to a group of *Cancellarias* rather abundantly represented on the subtropical part of the Californian coast, but of which no species has yet been found in a living state so far north before. This group includes *C. affinis*, *urceolata*, *cassidiformis*, and *obesa*. The present species is nearest to *C. urceolata*, which is smaller with much higher and more horizontal plaits and somewhat different sculpture and proportions. It is possible that *C. urceolata* in northern waters grows larger and presents a modified physiognomy, but the

rarity of specimens of this genus stands greatly in the way of a proper knowledge of the range of their variations. The Arctic forms of this group, *e. g.*, *Admete* and *Cancellaria modesta*, vary greatly, but the tropical forms are less known. As species go this appears to be sufficiently distinct. It is named, at the request of Mr. Rivers, in honor of Mr. A. W. Crawford, of San Francisco, a noted collector of shells, especially of that region. I may add that *C. cassidiformis* Sby. has been collected near Cerros Island, off the coast of Lower California, as well as *C. obesa* Hinds and *C. bullata* Sby. *C. cassidiformis* is also found fossil in the Miocene or Pliocene formation of Santa Barbara County, California. *C. tritonidea* Gabb and *C. vetusta* Gabb, from the Tertiary of California, are based on a young and a very aged specimen, respectively, of this variable species.

*Tellina Idæ* Dall.

(Plate VI, Fig. 3. Plate VII, Figs. 1, 4.)

Shell ovate-triangular, moderately elongate, white, compressed; exterior of the right valve slightly flatter, and with more prominent sculpture than the left valve; beaks small, pointed, prominent, laterally compressed, adjacent to each other; anterior part of the shell slightly longer than the part posterior to the beaks, evenly and regularly oval, the dorsal and basal curves almost identical; posterior dorsal slope steeper, rectilinear, obliquely truncate at its termination, the basal curve (behind the perpendicular from the beaks) similar to its anterior part as far as the flexure, which is narrow but well marked, its basal end moderately incurved; behind, it rises to a strong ridge the end of which forms a rostral projection, behind which, in the right valve, is a deeply impressed line a little in advance of the posterior dorsal margin, which is strongly compressed; on the left valve there are two lines with a narrow impressed area between them, above which the dorsal margin is swollen; in front of the beaks is a narrow, acute, deeply excavated, short lunule; behind the beaks is a large, narrow, still more excavated escutcheon, most of which is excavated from the left valve, which falls short of the right valve a little; the ligament is sunken in and about half as long as the escutcheon; it is quite invisible on a lateral view of the shell; the left valve is regularly, sharply, closely, concentrically grooved, and both are obsoletely, finely, radiately striate; the margin between the impressed area of the left valve and the escutcheon is more finely grooved than the rest and has a (somewhat irregularly) denticulate dorsal edge; the right valve has the concentric sculpture more distant and, ventrally, shows distinctly elevated narrow lines with wider interspaces regularly disposed, and also bears denticulations on its posterior dorsal margin; the umbones are nearly smooth; the shell gapes but little, chiefly at the end of the rostrum; internally the surface of the valves is smooth, the muscular and pallial impressions are brilliantly polished; besides the usual marks, in the specimen under examination there are, near the

posterior ventral angle of the pallial sinus, two small circular impressions and some obscure and irregular markings at the entrance of the sinus, all due, doubtless, to attachments of the mantle and probably inconstant or variable in different individuals; the anterior part of the pallial sinus nearly reaches the scar of the anterior adductor, and nearly the whole of the basal part is coincident with the line of the basal attachment of the mantle; the hinge plate is broad and subtriangular quite strong, bearing one prominent grooved tooth between two channels; behind the posterior channel, in the left valve, is a much narrower, obscure, and little-raised tooth; the corresponding second tooth in the right valve is anterior and similarly obscure; the left valve is destitute of lateral teeth, but in the right valve there is a short, strong, elevated, subtriangular, anterior lateral close to the anterior cardinal, and a more distant and feeble posterior lateral over the posterior adductor scar. Altitude of shell, 28.5; maximum longitude, 48; diameter, 8.5 millimetres, of which 5.0 millimetres is comprised in the left valve.

**HABITAT:** Long Beach, San Pedro, California; first collected by Mrs. G. L. Trowbridge, and forwarded for inspection by Miss Ida Shepard; subsequently by Mrs. Burton Williamson, of University, California Catalina Island, 16-38 fathoms; J. G. Cooper (fragment) and W. H. Dall (young shells). Fossil in the Miocene of San Diego, California.

This fine shell is a typical *Tellina*. It is apparently most nearly related to Deshayes' *T. denticulata* of the Cumingian collection. His description in several points, though insufficient for certain identification, agrees fairly well with this species. *T. denticulata* does not appear to have been figured. The shell, so named by Sowerby in Reeve's *Iconica*, is a *Macoma*, and probably a young specimen of *M. secta*. It does not agree with Deshayes' description, nor with his MS. outline in my possession. The species is not referred to by Bertin, in his revision of the *Tellinidæ* of the Paris Museum, and I have been unable to consult Römer's monograph. There is nothing corresponding to the present shell in Reeve's or Hanley's monograph. The shell referred by Carpenter (Mazatlan Catalogue, p. 38) to Deshayes' species is worn and not capable of being positively identified, while the habitat of Deshayes' type is unknown. Two specimens forwarded by Mrs. Williamson differ quite markedly in height from base to beaks. One, which Mrs. Williamson kindly presented to the Museum, was an almost perfect match for the specimen forwarded by Miss Shepard which is figured herewith; the other was proportionately less elevated.

Mr. Edgar A. Smith, Assistant in the British Museum, in charge of the conchological collections, after comparing the drawings here used to illustrate this species with Deshayes' type in the British Museum, and with their other *Tellinidæ*, writes of Deshayes' form: "It is evidently quite distinct from your shell, which I can not identify with anything in our collection." A sketch of Deshayes' shell, kindly made and sent by Mr. Smith, fully confirms his opinion of their distinctness, *T. denticulata*.

*lata* being shorter, more elevated and inflated, with the anterior part of the pallial sinus confluent with the anterior muscular impression. As the *T. denticulata* has never been figured we have thought it useful to reproduce Mr. Smith's drawing, which will be found at figures 2 and 3, Plate VII.

The species is named for Miss Ida Shepard, to whom we owe the opportunity of examining it, one of a group of energetic collectors and students of the local fauna who have recently made important additions to our knowledge of the molluscan fauna of southern California.

*Clementia subdiaphana* Carpenter.

(Plate VII, Figs. 5, 6.)

*Clementia subdiaphana* Carpenter, Suppl. Rep. Brit. Assoc., 1863, pp. 602, 607, 640; Proc. Acad. Nat. Sci. Phila., 1865, p. 56.

HABITAT: Vancouver Island, Lord; Puget Sound, Kennerly; Port Etches and southward on the Alaskan coast, 14 to 60 fathoms, Dall; off Drake's Bay, California, near the entrance to San Francisco Bay, dredged by Mr. J. S. Arnheim in 24 fathoms, and lent for examination by Mr. J. J. Rivers, University of California.

[The original specimens of this species were young and subdiaphanous. Specimens collected by the writer at Port Etches in 1874 are as large as *Venus mercenaria*, ashy and calcareous, but still relatively very thin. They are usually, especially the young ones, more elongate and *Callista*-like in form than the remarkably rounded specimen which Mr. Rivers has been so kind as to lend us for examination. As this fine shell has not been figured, I have taken advantage of the opportunity of putting its characters on record graphically. Inside it is of a dead chalk-white, with the muscular and pallial impressions polished, and also less obviously the border outside of them. The ligament is black and sunken; there is neither lunule nor escutcheon. The area where the lunule should be is slightly more polished and compressed than the adjacent surface, but has no circumscribing line. The beaks are small and incurved, so that they point away from the hinge line. The exterior is white with some fortuitous rusty spots, sculptured with strong, slightly irregular lines of growth. The surface between the lines has a slight silky luster. The valve figured has a maximum longitude of 62.5, an altitude of 58, and a diameter (excluding the teeth) of 18 millimetres. The pair, of course, would have had just twice that diameter.

The young shell is greenish, subtranslucent white, very thin, and usually more elongated in proportion than the adult here figured; but the forms completely intergrade. The locality whence the specimen was obtained is 600 miles farther south than before reported. On the other hand, Port Etches is about the same distance farther north and west than any locality for the species heretofore made public.

The following memoranda will serve to indicate some of the more remarkable new forms of the northwest coast, dredged by the *Albatross* during the past year or two and of which more detailed descriptions with figures are in preparation.

*Terebratella occidentalis* Dall var. *obsoleta* nov.

Shell more rounded than the original type with the sharp radiating ribs and sulci obsolete and represented chiefly by the brilliant scarlet lines of color which in the type surmount the ribs. U. S. Steamer *Albatross*, station 2984, in 113 fathoms, off Cerros Island, Lower California.

*Buccinum strigillatum*, sp. nov.

Shell with seven fully rounded whorls, deep suture, and hirsute epidermis; sculpture of numerous narrow flattened primary ridges with subequal channelled interspaces; aperture not expanded but with a wide deep sinus near the shoulder. Color white; length 42, breadth 27 millimetres. U. S. Steamer *Albatross*, station 3170, off Guadelupe Island, Lower California, in 167 fathoms.

*Buccinum taphrium*, sp. nov.

Shell thin, slender, with polished brown epidermis, with fine spiral striæ and conspicuous zigzag or spiral malleations; six-whorled, acute; suture deeply channelled; aperture white, with thick reflected lip and continuous thick callus on the concave pillar. Length of shell 40, breadth 18, length of aperture 15 millimetres. U. S. Steamer *Albatross*, station 3330, off Akutan Island, Bering Sea, Alaska, in 351 fathoms.

*Mohnia Frielei*, sp. nov.

Shell small, solid, six-whorled with short canal; white, covered with a dull green epidermis; upper whorls with numerous fine transverse ribs, last whorl smooth, no spiral sculpture. Length 16, breadth 7.5, aperture and canal 8 millimetres. U. S. Steamer *Albatross*, station 2860, off coast of British Columbia in 876 fathoms.

*Strombella Middendorffii*, sp. nov.

Closely resembling *S. norvegica*, but sharply, finely, spirally incised all over, and when adult, with a strong red yellow or brown reflected lip. *Tritonium norvegicum* Midd. (non Ohemnitz) probably; length 110, breadth 60 millimetres. The sculpture is of sharp, fine grooves, not the obsolete spiral striæ occasionally seen on *S. norvegica*. U. S. Steamer *Albatross*, stations 3216 and 3253, off Unimak Pass, Alaska, in 36-61 fathoms.

*Strombella fragilis*, sp. nov.

Shell thin, inflated, five whorled, pinkish with a thin dehiscent epidermis, fine wavy spiral striæ, strongly recurved canal and widely reflected outer lip. Spire very short, whorls irregularly ribbed near the shoulder or sometimes having imbrications like a *Trophon* in place of ribs; axis nearly pervious. Length of aperture 70, of shell 100, breadth 63 millimetres. U. S. Steamer *Albatross*, station 3252, off Unimak Island, Bering Sea, in 36 fathoms.

*Strombella melonis*, sp. nov.

Shell large, very thin, inflated, pinkish or yellow and white, last whorl much the largest, the aperture but little expanded, general form ovate, with numerous short obscure waves near the shoulder; surface faintly striated, with obscure spiral bands on some portions. Length 137, breadth 75 millimetres. U. S. Steamer *Albatross*, station 3227, off coast of Unalashka Island, Bering Sea, in 225 fathoms.

*Chrysodomus ithius*, sp. nov.

Shell slender, acute with seven rounded whorls, distinct suture, surface sculptured only with lines of growth and of a pale purple brownish tint. Aperture moderate not flaring, canal short. Length 70, of aperture 32, breadth of shell 30 millimetres. U. S. Steamer *Albatross*, station 3202, off the coast of California in 382 fathoms. Extremely perfect young specimens show a few faint spirals occasionally.

*Chrysodomus periscelidus*, sp. nov.

Like a diminutive *C. spitzbergensis*, white with yellowish epidermis, five strong spirals on upper and ten on last whorl with deep channels between them. Whorls eight, canal short, aperture grooved to correspond with the external spirals; throat white; whorls rounded, spire acute; length of shell 46, of aperture 19, breadth of shell 19 millimetres. U. S. Steamer *Albatross*, station 2842, off coast of Akutan Island, Alaska, in 72 fathoms.

*Chrysodomus phoeniceus*, sp. nov.

Shell resembling a small, delicately sculptured, round-whorled *Chry. liratus*. Whorls seven, upper ones with four or five strong cinguli, later ones with numerous fine intercalary threads between the primaries of which there are about twenty on the last whorl, color purplish brown; sculpture feeble, with a smooth band next the suture; there are no transverse ribs; the epidermis is elevated in thin serrate lamellæ in harmony with the lines of growth. Length of shell 56, breadth 30, length of aperture 30 millimetres. U. S. Steamer *Albatross*, Station 2862, off coast of British Columbia in 238 fathoms.

*Chrysodomus eucoamus*, sp. nov.

Shell white, solid, strong, seven whorled, with a lamellose epidermis raised in lines with spaces between them along the incremental lines,

the edges of the lamellæ sparsely fringed with projecting points. Upper whorls with a space in front of the suture and three strong sharp carinæ, the first interspace wider than the others; on the last whorl are seven or eight spirals, feebler anteriorly; epidermis yellowish olive, throat and pillar white, canal very short, operculum straight, unciform. Length of shell 33, of aperture 14, breadth of shell 18 millimetres. U. S. Steamer *Albatross*, stations 3227 and 2919, off coast of Unalashka Island, Bering Sea, in 225 fathoms.

This may prove to be a distinct group from *Chrysodomus* proper.

*Chrysodomus* (Sipho) *hypolispus*, sp. nov.

Shell polished, brown, with rounded whorls sculptured only by a few obsolete spirals and malleations with six or seven whorls, well rounded to a distinct suture and rather acute spire; canal very short and strongly recurved, axis almost pervious; outer lip sinuous, throat white, a well marked callus on the pillar and body. Length of shell 55, of aperture 28, breadth of shell 26 millimetres. U. S. Steamer *Albatross*, station 3254, in Bering Sea, Alaska, in 46 fathoms.

*Chrysodomus* (Sipho) *acoamus*, sp. nov.

Shell elongated, with six or seven whorls covered with a dull greenish epidermis and spirally sulcate with rather distant narrow shallow grooves, eighteen to twenty on the penultimate whorl; suture distinct, whorls flattened, canal very short and recurved; aperture white, without callus, lip hardly reflected. Length of shell 60, of aperture 25, breadth of shell 23 millimetres. U. S. Steamer *Albatross*, station 3329, off Unalashka Island, Bering Sea, in 400 fathoms. Many of the North Pacific shells of this group appear to have very short canals.

*Chrysodomus* (Sipho) *halibrectus*, sp. nov.

Shell much like a miniature of the last, with six whorls which are less flattened, weaker and finer spiral striæ, a longer canal, pink color on the pillar, and more appressed suture; the lip is thickened and a little reflected and there is a thin callus on the body. Length of shell 35, of aperture 17, breadth of shell 13.5 millimetres. U. S. Steamer *Albatross*, station 3330, off coast of Akutan Island, Bering Sea, in 351 fathoms.

*Trophon* (Boreotrophon) *scitulus*, sp. nov.

Shell, thin, small, white, five whorled; closely sculptured with regularly spaced low imbricate lamellæ rising to spines at regular intervals on the spirals; on the upper whorls two, and on the last whorl six spirals, of which at the shoulder the hindmost bears the longest spines and is separated from the suture by a wide space; there are on the last whorl thirteen grooved spines on this spiral; canal long, recurved. Length of shell 17.5, of aperture 11, breadth of shell 8.5 millimetres. U. S. Steamer *Albatross*, station 3227, off coast of Unalashka Island, Bering Sea, in 225 fathoms.

*Trophon (Boreotrophon) disparilis*, sp. nov.

Shell small, white, thin, elongate, with five whorls, with numerous hardly raised transverse ridges or lamellæ on the sutural side of the last whorl, while the anterior part of the same whorl is sculptured with four spiral, hardly raised ridges, and the transverse sculpture fails or becomes feebler; whorls rounded, suture deep, canal long, curved, aperture rounded, simple; length of shell 15, of aperture and canal 11, breadth of shell 7 millimetres. U. S. steamer *Albatross*, station 3048, off coast near Gray's harbor, Washington, in 52 fathoms.

*Puncturella (galeata Gld. var?) major* Dall.

Shell resembling *galeata* in general and especially in the interior, but very much larger; radii alternately large and small from the beginning; shell white; anterior slope rectilinear, posterior slope slightly arched and a little longer; internal margin crenulate; animal with a well marked verge, length of shell 57, breadth 42, height 27 millimetres. U. S. Steamer *Albatross*, station 3262, off coast of Akutan Island, Bering Sea, in 43 fathoms.

*Solemya Johnsoni*, sp. nov.

Shell resembling *S. macrodactyla*, Mabile and Rochebrune, from Orange Harbor, Tierra del Fuego, but larger, longer in proportion, the shorter end more tapering and the opposite end more rounded. Length of shell 115, height 48, diameter 18 millimetres. The cartilage pit is 30 millimetres, behind the shorter end and the greatest length of the digitate epidermis beyond the edge of the shelly valve is 23 millimetres. U. S. steamer *Albatross*, station 3010, off coast of Lower California, in 1,005 fathoms.

*Cryptodon bisectus* Dall.

*Venus bisecta* Conrad, Pal. Wilkes Expl. Exped., vol. x. App. 1, p. 724, pl. 17, figs. 10, 10a [Miocene of Astoria.] *Thyatira? bisecta*, Meek, S. I. checklist Mioc. Fos. 1864, *Conchocele bisecta*, Gabb Pal. Cal. II, p. 99, 1869.

Off Port Orchard, Puget Sound, by Prof. O. B. Johnson, of Seattle, Washington, and at station 2855, in 69 fathoms, off south coast of Alaska Peninsula by U. S. Steamer *Albatross*. This is undoubtedly the giant of the genus, some specimens reaching 2 inches in length.

Family **CARDITIDÆ**.*Calyptogena*, gen. nov.

Shell ovate, smooth, without radiating sculpture and covered by a conspicuous epidermis; valves closing hermetically; nonbyssiferous; the pallial line simple, the basal margin flat and entire. Shell without a lunule but with a long excavated escutcheon; the ligament deep-seated but practically external. Hinge, in the right valve with a  $\Lambda$ -shaped socket and a triangular cardinal tooth below it, behind which is a short, feeble, narrow, lateral tooth; in the left valve a  $\Lambda$ -shaped cardinal and



posterior lateral. The teeth become more or less obsolete in old shells. The mantle edge is minutely fringed, the siphonal openings papillose, the foot stout, blunt, ovate cylindrical. The shell is earthy in texture.

*Calyptogena pacifica*, sp. nov.

Shellequivalve, elongate, ovate, white with a thick greenish epidermis; sculpture of incremental lines; form much like *Petricola carditoides* Conrad, the beaks not prominent, the ligament stout, the escutcheon long, narrow, and deep. Length of adult shell 48, height 27, diameter 18 millimetres. The beaks are 14 millimetres behind the anterior end. U. S. Steamer *Albatross*, station 3077, off Dixon Entrance, Alaska, in 322 fathoms.

*Limopsis vaginatus*, sp. nov.

Shell large, ovate, with a dense brown hirsute epidermis, under which the valve is polished, radiately and concentrically striated; margin simple, polished, central part of the valves striate radially, the muscular scars bounded inwardly by a radial elevated ridge, most prominent behind the anterior scar. Hinge with ten anterior and five posterior teeth, separated by a gap, beaks little elevated, ligament wide, subtriangular and black; behind the hinge the cardinal margin is deeply folded in, forming when the valves are shut a long, very narrow pit more than one-fourth as deep as the whole width of the shell at right angles to that margin; this pit is also densely hirsute. The outline of the shell margin is thus made reniform. Length of shell with epidermis 34, height at right angles to the hinge line 30, diameter 12 millimetres. Length of pit 16 and depth 5.5 millimetres. U. S. Steamer *Albatross*, station 3330, off coast of Unalashka Island, Bering Sea, in 351 fathoms, and south of Unimak, in 80 fathoms, by W. H. Dall, in 1865.

WASHINGTON, June 6, 1891.

REFERENCES TO PLATES.

PLATE V.

- Fig. 1. *Trophon triangulatus* Carpenter, adult, 75 millimetres; p. 180.
2. *Eupleura muriciformis* Broderip, typical form, 37.4 millimetres; p. 174.
3. *Trophon triangulatus* Carpenter, young shell, type specimen, much enlarged, 11.5 millimetres; p. 180.
4. *Eupleura caudata* Say, var. *sulcidentata* Dall, type specimen, 19 millimetres; p. 176.
5. *Trophon cerrosensis* Dall, type specimen, 38 millimetres; p. 181.
6. *Trophon triangulatus* Carpenter, adult, viewed from above, diameter 50 millimetres; p. 180.
7. *Trophon cerrosensis* Dall, type specimen viewed from above, diameter 25 millimetres; p. 181.

## PLATE VI.

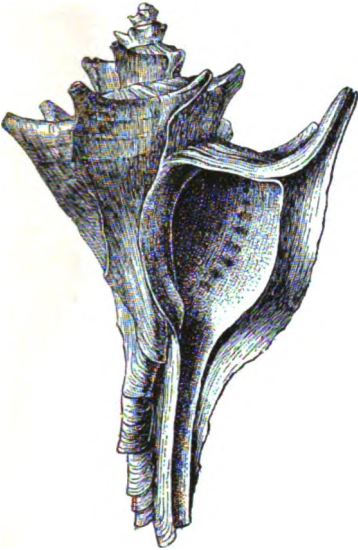
- Fig. 1.** *Cancellaria Crawfordiana* Dall, adult, 43 millimetres; p. 182.  
**2.** *Eupleura caudata* Say, typical form, 23.3 millimetres; p. 175.  
**3.** *Tellina Idæ* Dall, type specimen, side view, 48 millimetres; p. 183.  
**4.** *Fusus Kobelti* Dall, type specimen, 49 millimetres; p. 177.  
**5.** *Eupleura* (var.?) *unispinosa* Dall, type specimen, 40 millimetres; p. 174.  
**6.** *Chrysodomus Harfordi* Stearns, type specimen, 56 millimetres; the apical whorls are somewhat eroded and the edge of the outer lip defective; p. 178.

## PLATE VII.

- Fig. 1.** *Tellina Idæ* Dall, type specimen, view of interior, 48 millimetres; p. 183.  
**2.** *Tellina denticulata* Deshayes, from a sketch taken from the type specimen in the British Museum, by Mr. E. A. Smith, vertical view, natural size; p. 185.  
**3.** *Tellina denticulata* Deshayes, from the type specimen; p. 185.  
**4.** *Tellina Idæ* Dall, view from above of type specimen, 48 millimetres; p. 183.  
**5.** *Clementia subdiaphana* Carpenter, view from above of right valve; diameter exclusive of the teeth, 18 millimetres; p. 185.  
**6.** *Clementia subdiaphana* Carpenter, interior of adult right valve, 62 millimetres; p. 185.

**NOTE.**—As the figures are mostly enlarged, the actual longest diameter of the shell, as seen in the position figured, is mentioned in millimetres.

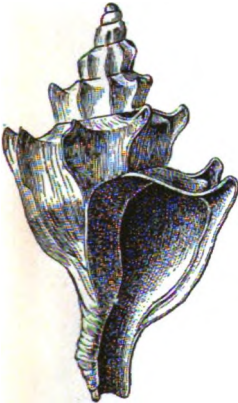




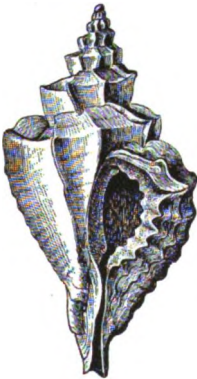
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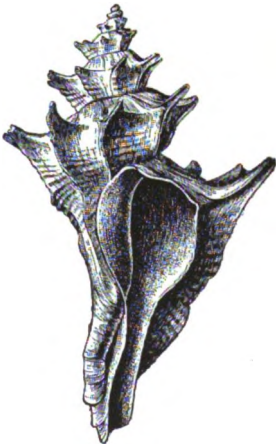
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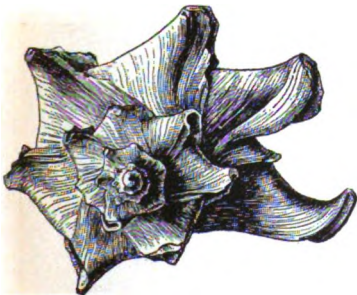
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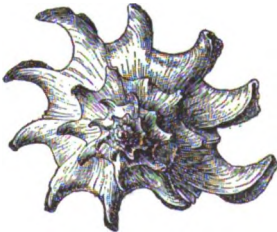
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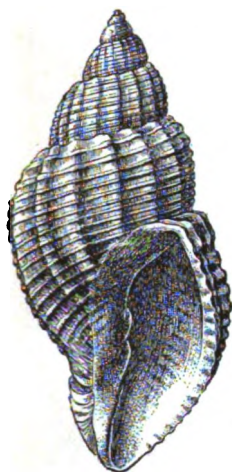


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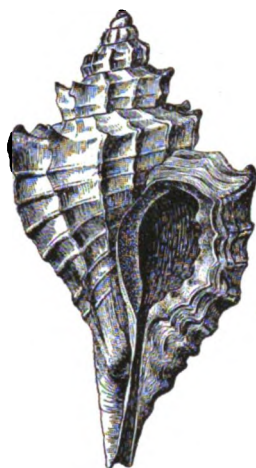


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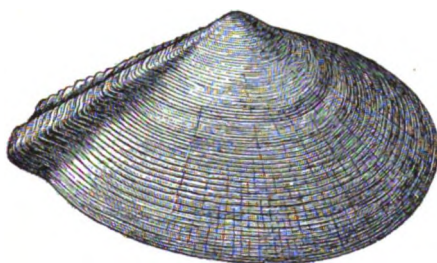




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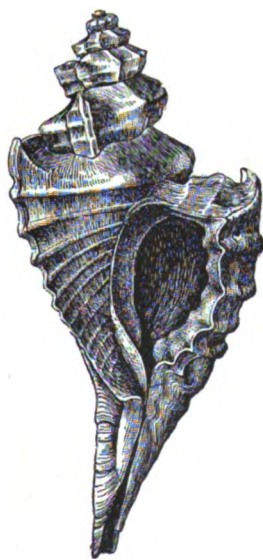
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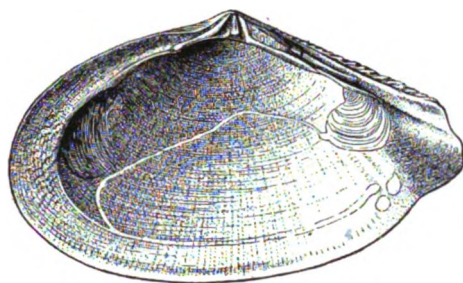


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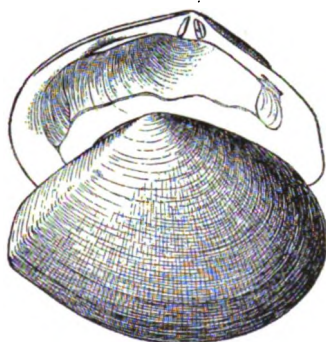




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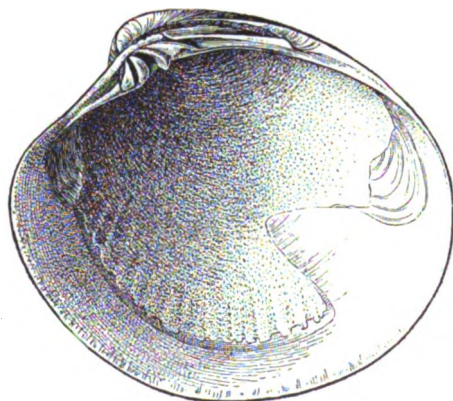
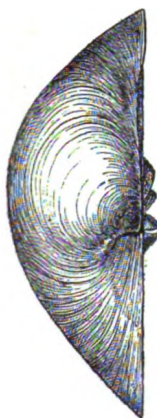
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DESCRIPTIONS OF TWO SUPPOSED NEW SPECIES OF MICE FROM  
COSTA RICA AND MEXICO, WITH REMARKS ON *HESPEROMYS*  
*MELANOPHRYS* OF COUES.

BY

J. A. ALLEN,

*Curator in the American Museum of Natural History, New York.*

Having recently had in hand a small collection of mammals from Costa Rica for identification, I found it desirable to examine in that connection as much material as possible from Central America and Mexico bearing upon the Costa Rican *Muridæ*. In response to my solicitation, Mr. Frederick W. True, curator of mammals in the U. S. National Museum, kindly secured for me the use of the specimens in the collection under his charge. They not only were of great assistance in the work in hand, but proved to include two forms apparently new to science.

*Oryzomys talamancæ*, sp. nov.

Pelage short, thick, soft, velvety. Above, russet-brown medially, mixed with blackish brown, passing gradually into clear yellow-brown on the sides; beneath, grayish white, the hairs being white or faintly yellowish white at the tips and gray beneath the surface, the basal gray portion showing through the surface, giving the effect of grayish white with a faint yellowish cast. Cheeks, sides of the neck, and flanks deep yellowish brown or golden cinnamon. Sides of the muzzle, dull soiled grayish white. Upper surface of fore and hind feet, dull pale yellowish gray, very scantily haired, and the toes nearly naked, except at the base of the claws. Soles entirely naked, tubercles 6. Ears large, blackish, naked. Tail about as long as head and body, naked, blackish above, dark brown below, hence indistinctly bicolored.

Length (approximate from skins), head and body, 114.3 millimetres (4.50 inches); tail, 114.3 millimetres (4.50 inches); hind foot (with claws), 30.8 millimetres (1.15 inches); ear, from crown, 13.7 millimetres (.54 inch); muzzle to eye, 17.8 millimetres (.70 inch).

Skull in general form very similar to that of *Oryzomys palustris*, but much smaller. Basal length, 28.5 millimetres (1.12 inches); total length, 31.2 millimetres (1.23 inches); palatal length, 16 millimeters (.63 inch); greatest breadth, 15.8 millimetres (.63 inch); least interorbital breadth,

5.3 millimetres (.21 inch.); nasals, 12.7 millimetres (.50 inch.); upper molar series, 5.1 millimetres (.20 inch). (Lower jaw lacking.)

Type  $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$ , U. S. National Museum, ♂ ad. Talamanca, Prof. W. M. Gabb.

This species is based on two specimens, skins, in the Gabb collection, belonging to the U. S. National Museum. One still retains the skull; from the other (the type) the skull has been removed, but, unfortunately, lacks the lower jaw. The two skins differ somewhat in coloration, and apparently represent different seasons of the year, one being in rather fuller and darker pelage than the other.

On the back of the labels I find written in pencil, "Near or = *H. laticeps* Lund," a species based on specimens from Lagoa, Santa Brazil. To say nothing of the wide separation of the habitats of the two, the present species is very much smaller than *H. laticeps*, and the resemblance in coloration is by no means close. Mr. Oldfield Thomas's *Hesperomys* (*Oryzomys*) *laticeps* var. *nitidus*, from central Peru (see P. Z. S., 1884, p. 452, pl. xlii, fig. 1), is also much larger than the present species, and evidently very different in coloration, as he speaks of its "dark, rich, rufous color."

#### *Hesperomys melanophrys* Coues.

*Hesperomys* (*Vesperimus*) *melanophrys* Coues, Proc. Acad. Nat. Sci., Phila., 1874, p. 181; Mon. N. Am. Roden., 1877, p. 102 (in part only).

Dr. Coues in describing his *Hesperomys* (*Vesperimus*) *melanophrys* considered it as doubtfully distinct from *H. mexicanus* of De Saussure. An actual comparison of the types of the two species, which, through the kindness of Dr. C. Hart Merriam, I recently had the opportunity of making, in company with himself and Mr. F. W. True, at the U. S. National Museum, has shown that they are not at all closely related. I have since then been able to study more critically the specimens—six in all—referred by Dr. Coues to this species in his final notice of *H. melanophrys*. His original description of it (Proc. Acad. Nat. Sci. Phila., 1874, p. 181) refers only to the single type specimen from which it was described; his later notice (Mon. N. Am. Roden., p. 102) refers in part to other specimens, only the first three of which (given in Table XXIX, l. c.), his diagnosis, and the main body of the article relate to *H. melanophrys*. In a note to the article as originally prepared he provisionally referred three other specimens to *H. melanophrys*, though recognizing that they presented many points of difference, respecting which he says:

Since writing the preceding, we have examined three other specimens from Tehuantepec, which, if the same, as the types of *melanophrys*, lessen the chances that the latter is different from *mexicanus* [De Saus.]. But they differ in many respects from the specimens just enumerated [the three originally referred to *melanophrys*], being so very much smaller that we can not satisfy ourselves of their identity. The tail only exceeds the body in one specimen, and here only a little; in the others, it is about as long, relatively, as De Saussure gives for *mexicanus*. That these specimens are not immature is shown by the fact that one of them is a nursing female. In color,

they are almost precisely like the foregoing, but do not show the black ring round the eye, nor the dusky spot at the base of the metatarsus. One of them is pure white below; another is grayish (it looks as if soiled); while the third has the faintest possible fulvous tinge all along the under parts." He says further: "Much more material than that now in our possession will be required to determine the limits of variation of this large, gray, *leucopus*-like mouse of Mexico, and fix the species upon secure basis.

In his three specimens originally referred to *H. melanophrys* (as shown by his tables of measurements), the length of head and body averages 4.02 inches and the tail 4.83, as against 3.20 and 3.10 respectively in the other three specimens mentioned in the above quotation. This difference, with the differences in coloration pointed out by Dr. Coates himself, clearly shows that the latter have no close relationship to *H. melanophrys*, but are strictly of the *leucopus* type.

*H. melanophrys* is a large, long-tailed, big-eared species, somewhat recalling the general aspect of *H. californicus*, from which, however, it differs greatly in coloration, and especially in cranial character, the skull being much heavier and much broader in proportion to its length, with the rostral portion greatly thickened, in comparison with the same part in *H. californicus*. There are also well-marked differences in dentition and in the form of the palatal region; the auditory bullæ are smaller and more spherical, and the condylar portion of the lower jaw is much broader, heavier, and less depressed.

*Hesperomys (Vesperimus) affinis*, sp. nov.

*Hesperomys (Vesperimus) melanophrys* Coates, Mon. N. Am. Roden., 1877, p. 102 (in part only).

Similar to typical *H. leucopus* in size, proportions, and cranial characters, but with a close general resemblance in coloration to *H. melanophrys* Coates.

Above brownish fulvous varied with blackish, darker along the median line, more fulvous along the sides. Below white, with a very slight tinge of yellow. Feet dull white; ears brownish, narrowly edged with white; tail brown, indistinctly lighter below, scantily haired.

Measurements (approximate from skins): head and body, 81.3 to 88.9; tail, 76 to 83; hind foot (including claws), 19.8; ear from crown, 4.5 to 4.8 millimeters. Skull: total length, 26.4; basal length, 25.9 millimeters; greatest width, 13.5; length of nasals, 11.4; lower jaw (from tip of incisors to condyle), 16; height (angle to condyle), 6.4 millimeters.

Type, No. 3333, U. S. National Museum, ♀ ad., Barrio, Tehuantepec, Mexico, October 30, 1868, Prof. F. Sumichrast. (This specimen presents a soiled grayish appearance below, evidently accidental.)

Two other specimens (♂ ad., No. 3334, U. S. National Museum; ♀? juv., No. 3335, U. S. National Museum, same locality and collector, October, 1868), are similar above, but one almost wholly lacks the faint

yellowish tinge below plainly seen in the others, which, however, I suspect may be due to soiling.

In the type the teeth are much worn, indicating full maturity.

This form is evidently a member of the *leucopus* group of Vespermice, having the same pattern of coloration as regards the extension of the dark color of the dorsal surface upon the limbs. The relative length of the tail to the length of the head and body is about the same as in *leucopus* proper, the tail being longer than in the *sonoriensis* group, although the color is not much different from occasional specimens of what is usually known as *sonoriensis*. It has, however, a longer hind foot, and the facial portion of the skull is longer and narrower than in average specimens of either *leucopus* or *sonoriensis*.

The specimens here under notice were provisionally referred by Dr. Coues to his *H. melanophrys*, in his supplementary note to his account of that species in "Monographs of North American Rodentia," p. 305, as fully explained above.

CONTRIBUTIONS TOWARD A MONOGRAPH OF THE NOCTUIDÆ OF  
TEMPERATE NORTH AMERICA. REVISION OF THE SPECIES OF  
MAMESTRA.\*

BY  
JOHN B. SMITH,  
*Professor of Entomology, Rutgers College.*

(With Plates VIII-XI.)

*Mamestra* Ochs.

Eyes hairy, legs unarmed, tibiæ not spinose, vestiture scaly. Moderate to large-sized species; primaries moderate, varying somewhat in form, usually trigonate and moderately elongate, more rarely stout; stumpy winged; apices from acute to rounded. Front, palpi, and thorax with usually rather coarse vestiture, the latter with a more or less obvious divided crest, sometimes quite prominent anteriorly. Abdomen with more or less obvious dorsal tuftings. Antennæ of the male serrate and bristled, ciliate or entirely simple, rarely in our species pectinated.

It is difficult to distinguish the hairy-eyed genera by separate description; they must be comparatively described, and even then the absolute differences are so small that the same species has been a *Xylomiges* and *Mamestra* or a *Teniocampa* and *Mamestra*, and the references could not in any case be very sharply criticized. The

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\* LETTER OF TRANSMITTAL.

SIR: I have the honor to transmit for publication the accompanying revision of the genus *Mamestra*, by Prof. John B. Smith. It is a continuation of the "Contributions toward a Monograph of the Noctuidæ of Temperate North America," and was in part prepared while the author was still connected with the Museum, and is based, to a large extent, on the material in the Museum Collection.

The genus *Mamestra* is one of the largest and best characterized genera of the Noctuidæ, and Professor Smith has brought his revision down to date, making it a most valuable contribution to American Lepidopterology. Nearly all the species are represented in the Museum collection, and with few exceptions the types of the new species have been deposited therein, so that the collection in this genus from North America becomes the most complete in the country, if not in the world.

Respectfully,

C. V. RILEY,  
*Hon. Curator of Insects.*

Prof. G. BROWN GOODE,  
*Assistant Secretary Smithsonian Institution,  
In Charge of National Museum.*

genera as a rule lack well-marked structural characters, and habits and comparative features assume a greater importance. It is my purpose to finish up the hairy-eyed genera as soon as may be and to present then a tabular statement of such differences as exist. It will bring out more strongly the thoroughly opinionative nature of the divisions in this part of the Noctuid series.

I have been unable to separate *Dianthæcia* from *Mamestra*, in practice, and have united them or rather left them united, as Mr. Grote proposed years ago. The single distinctive character—the salient ovipositor of the female—seems in our fauna to be inconstant in the same species, i. e., some females of a species will have the ovipositor exerted, others will not. I think this depends somewhat upon whether or not the insect had oviposited.

The work on this genus was first done before 1885, as part of the monographic work then in contemplation by Dr. Riley and myself, and was then based largely upon the New York and Brooklyn collections, as most accessible. Since that time the material has so increased in amount that during January, 1891, I rewrote the whole paper, basing it now upon the collections in the U. S. National Museum, which in fullness of series, if not in the number of species, excels all the other American collections of *Noctuidæ*. Many species unknown to me in 1884 have since come to my notice in one or both sexes, and some new material has needed attention. It is a somewhat interesting fact in this connection that whereas new species of the *Agrotid* and *Heliothis* series are constantly received in all sendings from the western high plateaus, *Hadena* and *Mamestra* are rare, the latter more particularly. On the Pacific coast the species are again more numerous, but they do not compare in numbers either of specimens or species with the Atlantic, or, better, boreal fauna.

I desire here to express my obligation to the owners of the large collections who have so liberally and kindly aided me, and also to Dr. Riley, the Curator of Insects in the National Museum, who has allowed me to make the fullest possible use of the material there. The Museum collection of *Mamestra* has been determined and arranged by me in accordance with the views in this paper, and the specimens are cited in the record of localities.

The species of this genus, though differing greatly when extremes of form are presented, yet afford no strong or evident superficial characters for their division into compact groups, the species of which should be closely allied. There is variation enough in structure and appearance; but it is rather individual than characteristic of groups, and can not serve for other than specific distinction in the majority of instances.

Two wide and very unequal divisions are indicated, though not very sharply separated, and the composition of the first group is not quite as homogeneous as desirable. In A, the antennæ have the joints

marked or serrate, laterally bristle-tufted in the male. In B, the male antennæ are simple, or at most ciliated. The division, as has been indicated, is an arbitrary one, and in A, the species as a whole have no close habitual bond of union; yet in the large pale species, *discalis*, closely allied as it is to *nimbosa* and *imbrifera*, barely comes within the definition of the group, while *leucogramma* for instance is completely isolated and agrees with itself only! No allied species are disassociated, however, and though perhaps not ideally the best, yet the divisions are practical at least.

Division A contains comparatively few species and no groupings are necessary.

In Division B the species are numerous, and it is possible to separate them into groups, which in most cases associate closely allied forms.

Group *W-maculata* is described in its name, though there is no species so dubbed. The species are all identified at a glance by the prominent W mark of the s. t. line, which is usually white and contrasting, varying somewhat in the length of the angles, but always nearly or quite crossing the terminal space. I should very much have liked to name this group *W-album*; but unfortunately the species has no white W, and, after all, Guenée called his species *U-album*, and meant what he said, for, as he describes it, the reniform is inferiorly outlined in white, making a U. Walker changed it to *V-album* and Mr. Grote made it *W-album*, effectually obscuring the meaning conveyed in the name as originally imposed.

Group *vindemialis* contains a few species of large size and red or black-brown color, the hind angle of primaries not retracted. The body is robust, with dense woolly clothing, and they should be quite readily referred.

Group *latex* also contains species of at least moderate size, never red or black-brown, narrower winged, the hind angle of primaries distinctly retracted. *Lubens* has broader wings than the type of the group and is different in maculation, but can not be referred elsewhere on account of the distinct retraction of the hind angle.

Group *adjuncta* contains rather small or only moderate-sized species, with blotchy white markings on a dark ground. There is a uniformity of genital structure, the harpes being abruptly bent at outer third.

Group *defessa* is negatively characterized and its species have no common bond of union. They are robust, the type with a resemblance to *trifolii*, with rather broad trigonate primaries, distinct apices, and oblique outer margin. The ♂ genitalia have no common character. The species are moderate in size and have no characters which would refer them to any other group.

Group *legitima* is characterized by moderately robust body and broad, comparatively short primaries, which have the apices obtuse and the outer margin rounded. Two rather well marked subgroups are indicated, of one of which *legitima* is typical, and of the other of which *goodelli* form the type.



Groups *renigera*, *olivacea*, and *laudabilis* agree in small size, short, rather obtuse primaries and general form of genitalia. The reniform is usually narrow, pale or white marked, and somewhat constricted medially.

In group *renigera* the harpes are produced into a long curved hook, and the clasper is nearly as long as the hook of the harpes.

In the *olivacea* group the harpes have the tip rounded, lappet-like, and the clasper is shorter cylindrical.

In group *laudabilis* the harpes have a long, narrow piece set at an angle to base, and this is obliquely truncate at tip. The clasper is short, thick, and beak-like.

There is a considerable similarity in the maculation of the species of the three groups, especially noticeable between the *renigera* and *olivacea* forms, and each of the groups forms a small aggregation of closely related and sometimes very variable forms.

Group 4-*annulata* is based on a small species, similar to the preceding in wing form; but the ordinary spots are subequal, white ring<sup>1</sup>, the transverse lines are obsolete, and there is a long black basal dash looped at the end to form the claviform.

Group *innexa* is also based on a single, rather peculiar species, first described as a *Perigrapha* by Mr. Grote. It is a reddish pearl gray in color, and has pale transverse lines. The primaries are narrow and have a depressed costa and somewhat prominent apices.

Group *pensilis* contains rather narrow-winged forms, with acute or rectangular apices and oblique outer margin. The species are of some shade of gray, very variable, and two of them uncomfortably close in superficial appearance, though perfectly distinct structurally.

Altogether we have an assemblage which differs more at its extremes than do the forms as a whole from a number of other genera.

In tabular form the group scheme separates as follows:

1. Antennæ of ♂ serrated and furnished with lateral tufts of bristles ..Dir. A.  
Antennæ of ♂ simple, merely ciliated laterally .....Div. B.   2
2. S. t. line with a prominent W-mark .....Group..W-MACULATA.  
S. t. line without such a mark .....3
3. Large red or black-brown species, hind angles of primaries not retracted..... Group..VINDEMIALIS.  
Large or moderate sized species, never evenly red brown, primaries narrower, hind angles distinctly retracted .....Group..LATEX.  
Moderate or rather small species with trigonate primaries, apices marked, hind angles not retracted .....4  
Moderate sized species with broad primaries, obtuse apices, and rounded outer margin .....5  
Small, stout, stumpy winged species, the costa not depressed.....6  
Small species, less robust, narrow winged, with determinate or somewhat produced apices, hind angles not retreating.....9
4. Maculation white, often blotchy; harpes abruptly bent at outer third..... Group..ADJUNCTA.  
Maculation not blotchy; colors usually luteous, resembling *trifolii*, genitalia various ..... Group..DEFESSA.
5. Wings varying in width, costa sometimes quite strongly arched..Group..LEGITIMA.

6. Ordinary spots not subequal, reniform usually narrow, pale or white marked, somewhat constricted medially; transverse lines distinct ..... 7
- Ordinary spots small, subequal, white; transverse lines obsolete..... 8
7. Harpes of ♂ with a long hook at tip; clasper nearly as long as harpes ..... Group..RENIGERA.
- Harpes of ♂ with tip rounded, lappet-like; clasper shorter, cylindrical ..... Group..OLIVACEA.
- Harpes of ♂ with a long narrow piece set at an angle to base; obliquely truncate at tip; clasper short, thick, beak-like..... Group..LAUDABILIS.
8. A long black basal streak with a loop at tip marking the claviform..... Group 4-ANNULATA.
9. Costa depressed, color a reddish pearly gray; lines pale..... Group..INNEXA.
- Costa not depressed; color ash gray or darker; lines dark or blackish ..... Group..PENSILIS.

### DIVISION A.

The species here associated have little in common save more or less distinctly serrated male antennæ. In wing form, in maculation, and in the genital structure of the male, the greatest diversity is found, and but for the fact that no better basis for group divisions could be found, no attention would have been paid to the antennæ at all.

Some slight groupings are possible, though the number of species in any one group is small.

At the head of the series I place four species, agreeing in large size (about 2 inches), pale grayish primaries, in which the apices are rectangular, the outer margin oblique, and in general style of maculation. The male genitalia are after one type, though by no means alike, and are described for each species.

*Discalis* is known by the comparative indistinctness of maculation, pale primaries, and white secondaries. The male antennæ are very slightly serrated and ciliated only. In the others of this series the secondaries are dusky.

*Rogenhoferi* is a rather dull, fuscous gray species, with an evident median shade, the s. t. line not well marked, preceded by a row of defining dark spots. The male antennæ are distinctly serrated and ciliated.

*Nimbosa* is distinctly marked, whitish. The s. t. line is concolorous, irregular. There is no obvious median shade, though a faint dusky line is traceable. The male antennæ are more distinctly serrate than in *discalis*, less so than in *rogenhoferi* and the joints are furnished with lateral bristles.

*Imbrifera* as compared with the preceding is sordid in appearance, and is strongly flushed with grayish fuscous. The s. t. line is broad, pale, and even. Secondaries blackish. The male antennæ are still more serrate and the lateral bristles stouter.

All of the preceding have very distinct, divided thoracic tufts.

Nearly equaling the preceding in size, but of a fine purplish or lilac gray shade, is *purpurissata*. The median lines are obsolete, the ordi-

nary spots large, the s. t. line very distinct. The secondaries are dusky and the thoracic tufts distinct. The western specimens seen by me have the ordinary spots confluent, and to this form the name *juncinacula* was given by me, with an erroneous generic reference.

*Insolens* is a moderate-sized species with narrower and more pointed wings, of a dirty pale luteous color and still paler maculation. The s. t. line is preceded by a series of trigonate black spots, and the thoracic tufting is not distinct.

*Leucogramma* is a small species, almost a miniature of *insolens* in color, wing form, and style of markings. The median lines are narrow, white, and even.

Following these is a series of small, stumpy winged forms, not very closely related to each other.

*Lepidula* is a beautiful, bright red brown species, with a somewhat contrasting, yellowish, reniform, and clean white secondaries.

All the other similar forms have dusky secondaries.

*Determinata* is a small, wood-brown species, with the median lines distinct, black, and even, all the maculation well marked.

*Meditata* is a deep, even, vinous brown, with blue powderings, all the maculation faint, powdery, not easily traceable. The species is an obscure one and readily recognized, interfering with nothing else in the series. The antennæ are serrate merely.

*Lustralis* is a paler, carneous gray, larger than the preceding, and better marked. The median and terminal spaces are more brownish, and the fringes are somewhat unusually long. The male antennæ are shortly pectinated.

*Detracta* is a broad-winged species, the primaries more ample than in any other species in the series, and this, with the mottled fuscous brown color, distinct median lines, and prominent black claviform, make the species readily recognizable. The ♂ antennæ are pectinated.

*Gnata* is dark ash gray, with a prominent s. t. line, preceded by a distinct yellowish white spot opposite the anal angle. The wing form is more like the *vicina* series, which indeed the insect much resembles in habitus, differing in the serrate and "brush like" antennæ.

Occupying an isolated position in this series is *distincta*, a pale ash-gray or whitish form, with narrow, subequal primaries, oblique slightly dentate outer margin, and somewhat retreating hind angle. A distinct black dash connects the transverse lines, crossing the median space. The species is not related to any other in this group; but seems to have affinities to *latex* and *passa*.

*Crotchii* is out of place anywhere, but may be conveniently sandwiched in here, as it has a prominent W-mark in the s. t. line, allying it with the following group. It is a robust species, sordid luteous to fuscous gray, the maculation sub obsolete, ordinary spots usually confluent, and claviform very large. In some specimens the s. t. line is indistinct, and the isolating character somewhat obscured.

In tabular form the species may be separated as follows:

1. Large species, s. t. line paler, without W-mark, preceded by black spots or shades, more prominent at middle and again at hind angle..... 2
  - Moderate in size, s. t. line preceded by a series of equal trigonate spots, wings narrow, apices distinct, rather prominent..... 6.
  - Small, or at most moderate-sized, species, the s. t. lines not preceded by dark shades; but the dark shade follows the line, or the terminal space is dusky ..... 7.
  - Moderate in size, median lines connected by a prominent black line..... 12
  - Moderate in size, a distinct W-mark in s. t. line..... 13.
2. Median lines distinct..... 3
  - Median lines wanting, or merely traceable..... 5
3. Secondaries white, primaries whitish gray..... DISCALIS.
  - Secondaries dusky ..... 4
4. A distinct median shade; sordid fuscous gray.
  - S. t. line not defined..... ROGENHOFFERI.
  - No obvious median shade.
    - S. t. line irregular, primaries bright gray..... NIMBOSA.
    - S. t. line even, color sordid, dull gray..... IMBRIFERA.
5. Primaries carneous or purplish gray; ordinary spots large, sometimes confluent..... PURPURISSATA.
6. Color dirty, pale luteous, maculation not prominent..... INSOLENS.
7. Sordid luteous gray, powdery, maculation white marked, confused, wing form of *insolens* ..... LEUCOGRAMMA.
  - Primaries various in color, not luteous gray, more stumpy winged..... 8
8. Secondaries white; primaries bright red-brown, reniform, somewhat contrasting, yellowish..... LEPIDULA.
  - Secondaries dusky ..... 9
9. Claviform small or wanting, concolorous..... 10
  - Claviform prominent, black..... 11
10. Pale wood-brown, median lines distinct, single, black, even..... DETERMINATA.
  - Deep vinous brown, with blue powderings, all the maculation faint, powdery, not easily traceable..... MEDITATA.
  - Carneous gray, powdery, maculation distinct, median and terminal spaces more brownish..... LUSTRALIS.
11. Costa arched, wings therefore broader and more rounded than usual; mottled fuscous brown, with yellowish shades..... DETRACTA.
  - Wings longer, narrower; dark ash gray; s. t. line prominent, preceded by a distinct yellow-white spot at anal angle..... GNATA.
12. Pale ash gray or whitish, narrow winged, with somewhat retreating anal angle ..... DISTINCTA.
13. Robust, sordid luteous to fuscous gray, the maculation sub-obsolete, ordinary spots usually confluent, claviform very large..... CROTCHII.

*Mamestra discalis* Grt.

1877. Grt., Bull. U. S. Geol. Surv., III, 797; *Mamestra*.

Grayish white irrorate with black scales; maculation undefined; transverse lines barely traceable; s. t. line irregular, concolorous, marked by the slightly darker terminal space and a preceding interrupted blackish shade; a row of terminal lunules; claviform small, powdered with dark scales; ordinary spots large, concolorous, indistinctly outlined by dark scales, cell between them black. The second-

daries are whitish, subhyaline, outwardly and on the veins shaded with blackish or fuscous; beneath pale, powdery, secondaries with a discal dot. Head and thorax concolorous with primaries; patagiæ black, marked at outer margin.

Expands 45–50 millimetres (1.80 to 2 inches).

HABITAT.—Colorado, California.

Two specimens are in the Museum collection, both from Colorado, one (Denver) collected by Bruce, the other, collection J. B. S.

The species is easily recognized by its large size, pale color of primaries and white secondaries. The male antennæ are but slightly serrated, laterally ciliated, and somewhat thickened.

The genital pieces together form almost a cylinder. The harpes are rather slender, strongly dilated at the tip, furnished inwardly with a stout spine and numerous spinules. At the middle of the harpes there is also a strong spine. The clasper is strong, corneous, but little curved, and forming the inferior margin of the whole piece.

*Mamestra rogenhoferi* Moeschl.

1870. Moeschl., Stett. Ent. Zeit., xxxi, 269; *Mamestra*.

Rather sordid, fuscous gray, all the lines marked, obsoletely geminate; ordinary spots moderate, concolorous. In the general course of the lines it agrees with *imbrifera*, but it differs in the less contrasting terminal space and narrower s. t. line, which is marked by a row of dark lunules. The claviform is only faintly indicated. The distinctive feature of the species is the very distinct median shade, and the species is nearer to *nimbosa* than *imbrifera*.

Expands 47 millimetres (1.83 inches).

HABITAT.—Labrador.

No specimens are in the Museum collection. By the courtesy of Mr. Moeschler I was enabled to examine the type, which is a male in good condition. The secondaries are uniformly fuscous, and the antennal joints are distinctly serrated and furnished with bristly tufts. The genitalia are very like those of *disalis*, but the tip of the harpes is truncated, not rounded. The single type specimen could not be more satisfactorily examined as to structure, but it is very recognizable, and obviously distinct from the allied forms.

*Mamestra nimbosa* Gn.

1852. Gn., Sp. Gen. Noct., ii, 77; *Aplecta*.

1857. Wlk., C. B. Mus., Lep. Het., xi, 555; *Eurois*.

1873. Grt., Buff. Bull., i, 102; *Mamestra*.

1875. Speyer, Stett. Ent. Zeit., xxxvi, 142; *Mamestra*.

Primaries whitish gray, more or less powdered with black scales; transverse lines evident, black, geminate; ordinary spots large, concolorous, outlined by a narrow black line; no distinct basal line; t. a. line lunulated between the veins, as a whole but little outcurved, a

blackish shade at inception; t. p. line with inner line lunulate and slightly sinuate; outer line even, shading into the s. t. space, which is dusted with gray, especially at costa; s. t. line narrow, pale, dentate, and sinuate; an indefinite W-mark on veins 3 and 4, inwardly marked and shaded with black; a row of black terminal lunules. Through the median space is an indistinct shade line, darkening the cell between the ordinary spots. Secondaries dusky, with a darker discal spot and median line, the latter paler shaded. Beneath, primaries dusky, with indefinite outer line and pale terminal space; secondaries pale, with dusky discal lunule, outer line, and shaded margin. Head and thorax concolorous, the former with a black line crossing front, the latter with a black line on collar, and patagiæ black margined.

Expands 48-52 millimetres (1.92 to 2.08 inches).

HABITAT.—Canada, Eastern and Middle States.

Six specimens are in the Museum collection, others in the duplicate series, labeled, Kendall, New York (Burnett); Sharon, New York, July and August (O. Meske); Lewis County, New York, August (C. V. R.); Manchester, Vermont, August 3 (J. B. S.).

This is a very distinct and strongly marked species, separated from *discalis* by the dusky secondaries and more definite maculation, and from *imbrifera* by its cleaner cut maculation, brighter color, and irregular s. t. line. Thorax with a prominent anterior divided tuft. Abdominal tuftings small and dark, easily rubbed off and obliterated. The antennæ of the male are very slightly serrate, the joints each furnished with a long stiff bristle on each side, as well as a bunch of stiff hair. The male genitalia are distinctive. The harpes are dilated at tip, somewhat acutely produced superiorly, furnished at inner side with two strong spines and a mass of strong spinules. A corneous, finger-like process crosses the harpe near base, where it joins the clasper. The clasper is very stout and heavy, broad at base, then suddenly constricted into a stout curved hook, somewhat dilated at tip.

The species seems nowhere common, though taken almost every year in small numbers where it occurs.

#### *Mamestra imbrifera* Gn.

1852. Gn., Sp. Gen. Noct. II, 76; *Aplecta*.

1857. Wlk., C. B. Mus., Lep. Het. XI, 555; *Eurois*.

1873. Grt., Buff. Bull., I, 102; *Mamestra*.

1875. Speyer, Stett. Ent. Zeit., xxxvi, 144; *Mamestra*.

Sordid dusky gray; transverse lines evident, geminate, but rather indistinct. Ordinary spots large, concolorous or slightly paler, outlined in black, and with white annuli. Basal half line distinct. T. a. line lunate, outwardly oblique. T. p. line lunulate, incurved as usual below reniform. S. t. line pale, rather broad, tolerably even, inwardly marked by dusky shadings, which, between veins 1 and 2 and 5 and 6, almost cross the s. t. space, which otherwise is paler than the rest of the wing. An indefinite median shade, darkening the cell between the

ordinary spots. Claviform dusky. Secondaries blackish, fuscous, with paler outer margin and a row of terminal black lunules. Beneath as in *nimbosa*. Head and thorax concolorous, with primaries irregularly mottled with gray. The thorax has a divided crest, similar to that of *nimbosa*. The ♂ antennæ are distinctly serrate, or "pyramidal toothed," the joints furnished with lateral long bristles and bunches of stiff hair.

Expands 47–50<sup>mm</sup> (1.88 to 2 inches).

**HABITAT.**—Canada, Eastern and Middle States. Six specimens are in the Museum series, labeled as follows: Orono, Maine (C. V. R., J. B. S.); Sharon, New York, July 24 (Meske); Schenectady, New York, July 1 (C. V. R.); Centre, New York, July 5 (Riley).

This is more common than *nimbosa*, and easily distinguished from it by the distinctly serrate antennæ, the darker color, narrow median, and wider s. t. space, and by the pale and rather broad even s. t. line.

The male genitalia consist of the curved harpes, strongly dilated and somewhat securiform at tip, the superior angle furnished with a single stout corneous spine, and the inner surface of tip else rather densely clothed with small spinules. There is also a corneous, finger-like process similar to that in *nimbosa*. Clasper very broad, convex, with the harpes forming nearly half a cylinder. Superiorly there is a long, stout, curved prong or hook, the inner edge of which is somewhat serrate.

The antennal structure of these, our three largest eastern species, is interesting, and shows how little real reliance can be placed upon this feature in grouping. In *discalis* they are nearly simple, the joints only furnished with tufts of hair. In *nimbosa* the joints are scarcely more serrate, but have distinct lateral bristles. In *imbrifera* the joints are distinctly serrate, the lateral bristles longer, and the bunch of hair is more distinct. Yet these species certainly can not be separated in any natural arrangement, and they are therefore associated here, though it is straining the term to speak of the antennæ of *discalis* as serrate.

#### *Mamestra purpurissata* Grt.

1864. Grt., Proc. Ent. Soc. Phila., III, 82, Pl. I, f. 5; *Eurois*.

1873. Grt., Buff. Bull., I, 102; *Mamestra*.

var. JUNCIMACULA Smith.

1882. Smith, Bull. Bkln. Ent. Soc., v, 67; *Hadena*.

Primaries pale purplish gray, tinged with blackish along costa, and reddish on the discal space. Transverse lines obsolete or but faintly indicated, single, blackish, approximate, irregular. S. t. line irregular, forming an imperfect W near middle; inwardly defined and shaded with purplish black. The ordinary spots are large, outlined by narrow purplish black lines. Claviform obsolete or very small, scarcely traceable. A series of black terminal lunules. Secondaries in the ♂ pale, with soiled outer margin; in the ♀ dusky. Beneath, primaries dusky, in the male with paler terminal space; secondaries pale gray. Head and thorax concolorous with primaries. Collar with a black line. Antennæ of the ♂ thickened, joints serrate and bristled.

Expands 44–53<sup>mm</sup> (1.76 to 2.12 inches).

HABITAT.—Northern, Eastern, and Middle States; Colorado, Utah.

The variety *juncimacula* has the ordinary spots confluent, else like the type form. How I came to refer the insect to *Hadena*, I can not now understand, since my memoranda show that I knew the eyes were hairy.

The Museum collection has six specimens in the regular series, others in the duplicates; localities as follows: Bar Harbor, Maine, August 27 (J. B. S.); Albany, New York, August 24, September 9 (Meske, C. V. R.). Of the variety there are two specimens, the type from Utah, Fort Thornburgh (J. B. S.); another from Morrison, Colorado, July 27 (C. V. R.).

It is perhaps worthy of note that none of the eastern material I have seen has any tendency to the confluent ordinary spots, while the western specimens show it as a rule.

The thorax is distinctly crested, the crest divided.

The male genitalia consist of a broad harpe, suddenly narrowed and then at tip dilated and inwardly spinulate. The clasper is from the center of the harpe, rather short and moderately curved, simple.

*Mamestra insolens* Grt.

1874. Grt., Buff. Bull., II, 65; *Dianthæcia*.

1881. Grt., Can. Ent., XIII, 130; *Mamestra*.

♂ *arietis* Grt.

1879. Grt., Bull. U. S. Geol. Surv. v, 207; *Mamestra*.

1881. Grt., Can. Ent., XIII, 130; pr. syn.

*carina* Morr.

1874. Morr., Proc. Bost. Soc. N. H., XVII, 158; *Tæniocampa*.

Luteous gray, transverse lines pale, margined with black. Ordinary spots large, concolorous or paler, broadly annulate with white. Basal line present. T. a. line outwardly margined with black, somewhat irregularly lunate, outwardly oblique. T. p. line inwardly margined with black, lunulate. T. p. line concolorous, sometimes marked by yellow scales. Terminal space darker, limiting the line outwardly, while inwardly it is marked by a row of black points. A terminal row of black lunules, fringes long, interlined with gray and black. Secondaries pale fusco-luteous, with white fringes. Beneath, both wings pale, with common line and discal dots. Head and thorax concolorous with primaries.

Expands 34–43<sup>mm</sup> (1.36 to 1.72 inches).

HABITAT.—California.

Four specimens are in the collection, all from California (J. B. S., C. V. R.), two of them from San Francisco County, California, August and October (through C. V. R.). The female has the ovipositor slightly exerted and is usually larger and darker than the male. Antennæ of the male serrate, with lateral tufts of bristles to each joint. The male genitalia are distinct. The harpes are broad, curved, and somewhat



angulate, dilated at tip and there inwardly furnished with a single row of spinules. The clasper is a single, rather short, slightly curved, corneous hook. This species is very readily recognized and easily distinguished from all its associates. It does not look like a *Mamestra* at first sight, and has little of the habitus of the genus.

The synonymy is based upon an examination of types and typical specimens. Mr. Morrison's description bears date in October, while Mr. Grote's is dated in May.

It appears from Mr. Grote's most recent list that he never recognized Morrison's species.

***Mamestra leucogramma* Grt.**

1873. Grt., Buff. Bull., I, 140; *Dianthæcia*.

1874. Grt., Buff. Bull., II, 64; *Dianthæcia*.

1881. Grt., Can., Ent. XIII, 130; *Mamestra*.

Sordid luteous gray, terminal space somewhat irrorate, with white scales. Transverse lines denticulate, filled with pale, the marginal lines scarcely discernible. S. t. lines marked with yellow scales and a few darker points. Ordinary spots slightly paler, very indefinite. A row of dark terminal lunules. Secondaries blackish fuscous, paler at base. Beneath, powdery fuscous, secondaries paler, all with an exterior dusky line. Head and thorax concolorous with primaries, the vestiture somewhat divergent. Abdomen with a basal tuft only. Male antennæ serrate and ciliate.

Expands 28<sup>mm</sup> (1.12 inches).

HABITAT.—California.

There are four specimens in the Museum collection from Los Angeles County, California, dated April, August, and October (through C. V. R.) and these agree with the type in Mr. Hy. Edwards's collection.

This is an ugly, inconspicuous species, not easily confused with any of its allies. The primaries are comparatively small, the outer margin oblique, apex somewhat produced, fringes long. There seems to be little or no variation and the resemblance to *insolens* is marked.

The male genitalia are peculiar. The harpes are narrow toward base, suddenly broader, resembling a cleaver, abruptly truncate at tip and furnished with an acute long spine. The clasper is a rather slender, curved, corneous hook.

The insect is not generally found in collections.

***Mamestra lepidula* Smith.**

1887. Smith, Proc. U. S. Nat. Mus., x, 463; *Mamestra*.

Bright, somewhat ferruginous brown, darker in the median and terminal spaces. An oblique light brown streak inferiorly in basal space. Transverse lines distinct, single, margined with pale violet blue. Basal line brown. S. t. line irregularly sinuate and dentate, distinct, yellow; apex of wing violet blue. Claviform small, pointed, velvety

brown. Orbicular oval or rounded, concolorous, defined and irrorate with blue scales. Reniform moderate, not constricted, whitish, somewhat marked with brownish, and irrorate with blue scales. The terminal space is also more or less irrorate with blue scales. Secondaries of ♂ white, of ♀ pale fuscous. Beneath pale, with yellowish irrorations and a common external line. Head and thorax concolorous with primaries. Abdomen fusco-luteous, with distinct dorsal tufts, that on the fourth segment most prominent. Antennæ of male distinctly serrate, the serrations bristled.

Expands 25<sup>mm</sup> (1 inch).

HABITAT.—Texas.

The pair from which the species was described is from Mr. Hy. Edwards, to whose kindness I owed one of the specimens, now in the National Museum collection.

This is one of the prettiest of our species; its bright colors, bluish median and yellow s. t. lines, and pale reniform, rendering it easily recognizable. The fringes of primaries are long, even, cut with obscure violet.

The harpes of the male are moderate, but little dilated at tip and rounded. The clasper is simple, stout, rather short, curved, somewhat irregularly enlarged at tip. It is utterly unlike anything else in this series.

*Mamestra determinata*, sp. nov.

Head and thorax carneous gray, much as in *lustralis*. Primaries pale reddish-gray brown or pale fawn, the median space a deeper shade of same color. T. a. line well removed from base, single, black, outwardly oblique and outcurved between the veins. This leaves a large evenly colored basal space taking up on inner margin fully half of the wing. T. p. line single, black, fine, crenulate, outcurved over cell and thence almost parallel with outer margin. S. t. line indicated only by a dusky costal patch in s. t. space, and by some vague darker shadings in terminal space. An interrupted dark terminal line, and a pale line at base of fringes. Claviform a small cusp attached to t. a. line. Orbicular vague, slightly paler, moderate in size, and entirely indefinite. Reniform large, upright, oval, paler than ground color, blackish, filled interiorly by a somewhat diffuse, angulated, vague median shade. Secondaries smoky, outwardly darker, a yellowish line at base of fringes. Beneath, whitish, powdery, with a blackish extra-discal line and a small discal spot.

Expands 30<sup>mm</sup> (1.20 inches).

HABITAT.—Foothills, Colorado (Bruce).

A single male specimen in good condition, easily distinct from all its allies. It has more the maculation of *lustralis*, but very much better defined, the ground color also different. In genital structure, on the contrary, the resemblance to *meditata* is striking, and shows the refer-

ence indicated by the antennæ to be in this case a sound one. These antennæ are furnished with short pointed lateral processes, which are tipped with bristle tufts.

*Mamestra meditata* Grt.

1873. Grt., Buff. Bull., i, 104; *Dianthæcia*.

1881. Grt., Can. Ent., XIII, 130; *Mamestra*.

Reddish fuscous, irrorate with bluish scales, powdery. Transverse lines indistinct, geminate, sometimes relieved by a pale included shade. Basal line not traceable. T. a. line outwardly oblique, waved. T. p. line more upright than outer margin, slightly dentate on veins. S. t. line indicated by a slight difference between terminal and s. t. space. Claviform obsolete. Ordinary spots moderate, concolorous, often barely traceable, usually marked by paler scales. Secondaries dark smoky, fuscous, paler toward base. Beneath, with a reddish shade powdery, a broad exterior dusky line. Head and thorax concolorous tuftings not prominent. The male antennæ serrate, the serrations bristled.

Expands 27 to 35<sup>mm</sup> (1.08 to 1.40 inches).

HABITAT.—Canada to Virginia, west to the Mississippi.

Eleven specimens are in the Museum series, others in the duplicate material. The localities are, New York (C. V. R., J. B. S.); Northern Illinois (C. V. R.); Holderness, New Hampshire, September (C. V. R.); Washington, District of Columbia, August 8 to September 14 (C. V. R.).

This is a common and obscurely marked insect, related to *lustralis* with a somewhat similar wing form; but much more obscurely marked.

The genitalia of the ♂ consists of the long harpes constructed near the middle and dilated toward tip, where it is inwardly fringed with spinules. Behind the middle arise two stout corneous hooks, slightly curved, the one projecting upwards, the other downwards.

*Mamestra lustralis* Grt.

1875. Grt., Can. Ent., VII, 223; *Dianthæcia*.

1881. Grt., Can. Ent., XIII, 127; *Mamestra*.

Lilac gray, median space more reddish. Median lines obsolete, geminate, usually one of the lines only distinct; t. a. line preceded, followed by a narrow pale shade. Basal line present, fragmentary. T. a. line outwardly oblique and curved between the veins. T. p. line lunulate, nearly parallel with the outer margin, a prominent tooth on vein 1. The s. t. line is usually distinct, pale, its course sinuate, always marked near hind angle with a caraneous or yellowish blotch. Sometimes the terminal space is strongly irrorate with bluish-gray scales and the line becomes more or less completely lost. Claviform rarely complete, usually only the superior portion outlined and having the appearance of a spur from the t. a. line. Ordinary spots usually pale narrowly outlined with black, usually with a traceable pale interior

annulus. Orbicular variable in form; reniform rather narrow, somewhat lunate. Secondaries fuscous, paler toward base, sometimes with an extra-median darker line. Beneath, powdery, with common exterior line and discal dot. Head and thorax concolorous with primaries. Antennæ of male shortly pectinated, the processes bristled.

Expands 27 to 32<sup>mm</sup> (1.08 to 1.28 inches).

HABITAT.—Canada to Virginia, west to Wisconsin.

Four specimens are in the Museum collection; localities as follows: Maine; Racine, Wisconsin (C. V. R.); Maryland (J. B. S.). The fringes are long and even, the primaries rather short, broad, and trigonate. The species is rather well marked and not easily confounded with any other.

The male harpes are obtusely angulate, very slightly enlarged toward middle, the tip inwardly spinulose. Clasper stout, corneous, simple, beak-like.

*Mamestra detracta* Wlk.

1857. Wlk., C. B. Mus., Lep. Het. xi, 752 *Hadena*.  
*claviplena* Grt.

1873. Grt., Buff. Bull., i, 194; *Mamestra*.

1881. Grt., Can. Ent., xiii, 128; pr. syn.

Fuscous brown to blackish, sometimes with a yellow suffusion. In dark specimens the transverse lines are obsolete, ordinarily they are distinctly geminate; t. a. line with an outward curve, lunate between the veins; t. p. line parallel with outer margin, irregularly dentate or lunulate. S. t. line always visible, narrow, pale, irregularly sinuate; a larger pale spot at hind angle, which is, however, often obsolete. Basal line distinct, geminate. An obvious, short, black, basal streak. Claviform moderate, filled with black, always distinct, and forming a prominent feature in the appearance of the insect. Ordinary spots somewhat paler than ground color, black-margined. Orbicular usually round or oval, rarely oblong; reniform large, kidney-shaped. Secondaries dark, smoky brown or fuscous. Beneath variably dark, powdery, a distinct common line and discal dot. Head and thorax concolorous with primaries. Antennæ of ♂ shortly pectinate, the branches setose.

Expands 27 to 35<sup>mm</sup> (1.08 to 1.40 inches).

HABITAT.—Canada; Eastern, Middle and Central States. Eleven specimens are in the Museum series, others in the duplicate material. The localities are as follows: Sharon, New York, July 15 (Meske); New York; Orono, Maine (J. B. S.); Washington, District of Columbia (C. V. R.).

The primaries are broad, the costa arched, outer margin rounded. The wing form and the distinct black claviform spot will render this species easily recognizable.

The genitalia of the male are peculiar and difficult to describe. The harpes are slender, elongate, curved, broadly and roundly dilated at tip, which is inwardly spinulate. The clasper consists of a chitinous

shell at base, from which proceed a semimembranous, cylindrical, curved hook, enlarged toward base, and a spoon-shaped appendage, furnished at tip with a stout pointed spine.

The species is not uncommon in the more northern part of its range, but seems not often taken southwardly.

***Mamestra gnata* Grt.**

1882. Grt., Can. Ent., XIV, 170; *Mamestra*.

Dark ash gray, with a sordid luteous shade added through center of primaries. The transverse lines are geminate, not very well defined, their course as in the allied species. S. t. line narrow, pale, sinuate, marked more distinctly by the contrast between the dark terminal and paler s. t. space. Basal line present, but imperfectly marked. Ordinary spots moderate, slightly paler, with whitish annuli. Claviform small, concolorous or dark, outlined in black. Between veins 1 and 2 and between the t. p. and s. t. lines there is a defined pale patch, giving the species a characteristic appearance. Secondaries white, with soiled veins and outer margin. Beneath, pale, powdery. Head and thorax concolorous with primaries; a black line crossing collar. Tuftings distinct but not prominent. The antennæ of the male are distinctly serrate and laterally tufted.

Expands 32<sup>mm</sup> (1.28 inches).

HABITAT.—Arizona, New Mexico.

A single specimen from New Mexico (J. B. S.) is in the Museum collection. Mr. Neumægen has the male type. The species is easily known by the resemblance to the *vicina* group and the large pale spot near hind angle, a unique combination with the antennal structure. The harpes of the male are broad, nearly equal, and obliquely truncate at tip, where they are furnished with a row of stout spinules. The clasper consists of a simple, small, slightly curved, corneous hook.

***Mamestra distincta* Hübner.**

1810. Hbn., Samml. Ex. Schmett, I, Pl. 194; *Achatia*.

1816. Hbn., Verzeichniss, 219; *Astraptis*.

1852. Gn., Sp. Gen. Noct., II, 91; *Hadena*.

1857. Wlk., C. B. Mus., Lep. Het., XI, 583; *Hadena*.

1863. Grt. & Rob., Trans. Am. Ent. Soc., II, 197, Pl. 3, f. 72; *Hadena*.

1874. Grt., Buff. Bull., II, 156; *Mamestra*.

*ritis* French.

1879. French, Can. Ent., XI, 76; *Dicopsis*.

1879. Grt., North Am. Ent., I, 16; pr. syn.

Whitish gray, darker shaded through median space above claviform and in s. t. and terminal spaces. Basal space pale, the half line indefinite. T. a. line geminate, evenly curved outwardly and oblique. T. p. line geminate, lunulate, one-fourth from and nearly parallel with outer margin. Ordinary spots large, paler than the surrounding space, not distinctly outlined. Claviform large, broad, concolorous, from the apex

sending out a broad black mark which reaches the t. p. line and with the claviform connects the median lines. Below this line the median space is pale; above, tinged with fuscous, except that from the reniform a pale shade runs obliquely to apex. Beyond the t. p. line the inner margin and an oblique apical shade are pale, else strongly marked with fuscous. S. t. line obsolete, marked by a few black venular points. Secondaries whitish at base, outwardly fuscous. Beneath, pale, powdery, with common outer line and discal dots distinct black. Head and thorax concolorous with primaries; head with a distinct transverse black line; collar with a transverse dark line, fuscous-tipped and somewhat produced at middle; patagiæ black margined; tufts not prominent. Abdomen tufted at base only. Antennæ of male slightly but distinctly serrate, the joints with tufts of fine hair.

Expands 37<sup>mm</sup> (1.50 inches).

HABITAT.—Canada to Texas, Illinois, and Central States.

Six specimens are in the Museum collection from Pennsylvania (Meske); Central Missouri (Murtfeldt); Philadelphia (C. V. R.).

This species is easily recognized among the species with which it is placed by the longitudinal black line through the median space, connecting the median lines. The palpi are very short, straight, and scarcely exceed the front. Among the *Mamestras* it is perhaps nearest to *latex* in wing form and appearance, and forms a very decided step toward *Xylomiges*.

The harpes are long, slightly narrowed at middle, dilated and obliquely drawn out at tip, and inwardly spinulated. Clasper short, slightly curved, acutely terminated, beak-like, corneous.

Professor French has described the larva on grape.

***Mamestra crotchii* Grt.**

1880. Grt., Bull. Bkln. Ent. Soc., III, 29; *Mamestra*.

Sordid luteous gray or fuscous, the transverse maculation obliterated. S. t. line marked by sagittate dark dashes, forming a distinct W-mark. A distinct black basal streak, reaching to the large heavily black-marked claviform. Ordinary spots large, usually confluent. A row of dark terminal lunules. Secondaries smoky fuscous. Beneath, pale, powdery, veins marked with blackish; a distinct discal-dot. Head and thorax concolorous with primaries. The joints of the male antennæ are serrate and laterally furnished with distinct tufts of hair.

Expands 36<sup>mm</sup> (1.44 inches).

HABITAT.—Colorado, Oregon, California.

The California specimen from the Museum collection (June, Placer County, red No. 309, through C. V. R.) is darker in shade than the others and has been marked variety *fusculeuta* by me.

This singular species is readily known by its robust sordid appearance and peculiar maculation; the confluence of the ordinary spots, the large claviform, and the obsolete transverse lines forming strong dis-

tinctive features. Mr. Grote compared the species to *trifolii*, from which it differs in antennal structure, but which it very strongly resembles in the sexual characters. The harpes are broad basally, then suddenly and obtusely angulated, and this arm again acutely angulated so as to form a V. The tip is rounded and somewhat enlarged, inwardly spinulose. The clasper is stout, corneous, bent at nearly a right angle.

#### DIVISION B.

This division differs from the preceding only in the simple or merely ciliated antennæ of the ♂. As the groups into which it is divisible have been already defined, nothing more is necessary under this head, and I proceed at once to the treatment of the special groups.

#### Group W.-MACULATA.

The distinctive feature of this group, as has been already stated, is found in the distinct W-mark of the s. t. line of primaries. The species so associated are readily distinguished, and some of them are really related. Unfortunately, however, as a whole the group is nearly as artificial as the one immediately preceding, and there is a wide range of difference in habitus, color, and sexual structure. For the present purpose of aiding in the identification and arrangement of species and in describing their peculiar sexual and other characters, the association is the best I can devise. At a future time, when abundant material of all the species will enable proper associations to be arrived at, a better sequence may be attained.

A series of four species is separated off by having the median space somewhat darker, the transverse lines distinct, complete.

*Farnhami* is unique in maculation, and has the habitus of a *Prodenia*. The color is bright, violet brown, and the pale, yellowish streaking through the median space over the claviform gives a distinctive appearance difficult to mistake.

*Liquida* also stands solitary. It is a smaller species than *farnhami*, and very differently marked and colored. Over the fuscous-brown ground is a bluish irroration, very strongly marked in basal and s. t. space. A very distinct, pale shade of variable width follows the course of vein 2, across the median space.

*Capsularis* and *vittula* agree in rather broad primaries and unusually short thorax, which gives the insects a rather peculiar appearance. The vestiture is somewhat coarse, and the abdominal tuftings are not distinct. Both are bluish ash-gray in color.

*Capsularis* is distinguished by the large white orbicular, the upright t. a., and strongly incurved t. p. line.

*Vittula* is similar in general appearance, but the orbicular is small, centered with dusky. The t. a. line is outwardly and the t. p. inwardly oblique, the median space therefore triangular.

The remaining species of the group have the median space concolorous or not darker than the rest of the wing.

*Prodeniformis* resembles in wing form and thoracic structure quite strongly the preceding two species, but is obviously distinct. The median lines are incomplete, a pale streak surmounts the claviform, and a broad pale shade runs though the s. t. space. The orbicular is narrow and oblique. This peculiar species somewhat resembles Mr. Grote's figure of *Admetovis oxymorus*, and indeed the description indicates that he had a male of this species associated with the female type which was figured.

*Atlantica* and *desperata* are red-brown species, broad-winged and with a less oblique outer margin. In *atlantica* the lines are incomplete, but the maculation is clear cut, the colors bright.

In *desperata* everything is vague except a short black basal dash. The median lines are complete but not distinct; the ground color is overlaid by a whitish film, leaving all vague and dull.

*Canadensis* in wing form is like *subjuncta*, but lacks the connecting black dash between the median lines. The genitalia are like *atlantica*, which in general the species also resembles in maculation, save that the median lines are distinct.

*Subjuncta* and *grandis* are distinct in having elongate wings, in which the hind angles are somewhat retracted. A distinct black transverse line connects the median lines and additionally distinguishes the species.

Inter se, *subjuncta* is evenly brown in color, while *grandis* has a broad bluish-white shade through subterminal space and is also larger.

*Nevada* seem to belong here, or perhaps nearer to *canadensis*; but I have not seen a specimen.

Differing from all the preceding by sordid, dark, powdery ashen-gray color, is *invalida*, in which the wings are trigonate, with well-marked apices, distinct median lines, and a narrow black line through the median space connecting them.

*Trifolii* has much the wing form of the preceding, but the wings are dirty luteous in color, the lines distinct. This is the only one of the W-marked series in which the color is yellowish, and it is therefore readily distinguished.

In synoptic form the scheme would be as follows:

Median space darker, transverse lines complete.

An oblique pale streak along the course of vein 2, through the median space.

Violet-brown; s. t. space not paler ..... *farnhami*.

Median and terminal space fuscous brown, else bluish white, maculate with brown ..... *liquida*.

No such pale streak.

Orbicular large, round, white; t. a. line upright; t. p. line incurved below reniform ..... *capsularis*.

Orbicular small, dark centered; median lines oblique, regularly narrowing the median space inferiorly ..... *vittula*.



Median space concolorous, not darker.

Lines incomplete, or at least superiorly indefinite.

A pale streak surmounting vein 2; a bluish-white shade through s. t. space; orbicular small, narrow, oblique. .... *prodeniformis*.

Even red brown, rarely with pale median and subapical shade; orbicular large, oval, oblique; wings broad, maculation clear and distinct. .... *atlantica*.

More powdery, even; the basal dash only black, distinct, all else nearly concolorous. .... *desperata*.

Wings narrower; fuscous brown; orbicular moderate, transverse lines more distinct. .... *canadensis*.

Lines complete, connected by a black dash.

Brown, even; no pale s. t. shade. .... *subjuncta*.

Brown; a distinct pale s. t. shade. .... *graudis*.

Dark ash-gray; even, powdery, connecting line fine. .... *invalida*.

Lines complete, no connecting line.

Color luteous, with more or less definite maculation. Reniform always large, inferiorly darker. .... *trifolii*.

#### *Mamestra farnhami* Grt.

1873. Grt., Buff. Bull., 1, 103, Pl. 3, f. 2; *Mamestra*.

Fuscous brown, basal and s. t. spaces with a distinct violet shade. Lines black, geminate, included space paler. Basal line present. T. a. line upright, angulate between veins. T. p. line forming an obtuse angle opposite the reniform, then scarcely lunulated in an almost rigid oblique line to the margin. S. t. line narrow, yellow, distinct, arising from the pale apical patch, running thence obliquely to hind margin, interrupted on veins 3 and 4 by prominent sharp teeth, which touch the outer margin and form a prominent, sharply cut W. Terminal space somewhat darker; apical pale patch and s. t. line preceded by black, sagittate dashes. Claviform concolorous, large, black-margined. Ordinary spots rather narrow, concolorous, black lined, and with an inner pale annulus. Surmounting the claviform, and from the lower portion of the orbicular, is an oblique, pale, creamy, yellow shade, similar to that in *Prodenia*. There is a row of terminal black lunules. Secondaries fuscous, towards base paler; a dusky, discal lunule, and row of blackish terminal lunules. Beneath, powdery, purplish, with exterior common line and discal dot. Head and thorax purplish violet, the latter with distinct fore and aft tuftings. Abdomen fuscous, basally tufted.

Expands 37-42<sup>mm</sup> (1.50 to 1.68 inches).

HABITAT.—Colorado.

This uniquely marked species has a strong resemblance to *Eupsepho-pæctes* and *Prodenia*. Its bright colors and unique maculation make it easily recognizable. I have seen only a single female (type) specimen from Mr. Hy. Edwards's collection. Mr. Grote, who had both sexes before him, says the male antennæ are simple, very shortly ciliate beneath. In his specimens the ground color seems to have deeper "blackish, with a dark-green cast," while the violet shadings Mr. Grote calls "purplish."

*Mamestra liquida* Grt.1881. Grote, Papilio, I, 58; *Mamestra*.

Fuscous brown, strongly irrorate with bluish gray in basal space, along inner margin, and in s. t. space—the latter is, indeed, chiefly bluish gray, more or less irrorate with the ground color. Transverse lines geminate, included space pale, the defining lines hardly distinct. T. a. line oblique, slightly lunate; t. p. line lunulate, parallel with outer margin. S. t. line broad, yellowish, marked by the dark terminal space and a fuscous preceding shade; its course is arcuate, interrupted on veins 3 and 4 with a variably prominent but always distinct W-mark. A row of black terminal lunules. The basal space is powdery, varying in predominating color; sometimes it is more gray, sometimes more fuscous. Usually the basal line is traceable. The median space is fuscous brown, powdered with gray along inner margin; a more reddish shade through center and beyond the reniform, and a distinct but variably broad gray shade along vein 2, which sometimes becomes a very prominent feature. Claviform, with velvety black outline, moderate in size. Orbicular usually oblong, oblique, gray, with sometimes a dusky center. Reniform upright, rather elongate, somewhat constricted at middle, with a reddish shade. S. t. space prevailing blue-gray; a reddish-brown costal shade, narrowing suddenly, and following t. p. line as a faint cloud. Secondaries sordid fuscous, rather paler through the center. Beneath, somewhat ocherous, powdery, with a discal lunule on all wings. Head and thorax concolorous with primaries.

Expands 35–38<sup>mm</sup> (1.40 to 1.52 inches).

HABITAT.—Washington.

Wanting in the Museum collection. This species is readily recognized by the bluish gray s. t. space and oblique line of the same color through median space. It has a rough, powdery appearance, not easily mistaken, and is very distinct from all its congeners.

The harpes of the male are rectangularly bent at one-half the entire length and strongly dilated at tip. At the outer edge of this dilation is an acute tooth; at the inner face it is spinulated. At the angulation of the harpes is a concave corneous process, forming the clasper, which is difficult to describe, and is more readily understood by a reference to the figure. In the sexual characters the resemblance is strongly to *legitima* and more so to *liquida*, and indeed the superficial appearance is much the same, save for the distinct W in the s. t. line. A thoroughly natural grouping would associate these species, and some day another more easily visible character may enable this to be done.

*Mamestra capsularis* Gn.

1852. Gn., Sp. Gen. Noct., II, 22, Pl. 8, f. 3; *Dianthæcia*.

1857. Wlk., C. B. Mus., Lep. Het. XI, 505; *Dianthæcia*.

1881. Grt., Can. Ent., XIII, 128; *Mamestra*.

*propulsa* Wlk.

1857. Wlk., C. B. Mns., Lep. Het. XI, 523; *Raphia*.

1868. Grt. & Rob., Trans. Am. Ent. Soc., II, 78; pr. syn.

Fuscous, with gray shadings and geminate black transverse lines. Basal line present, geminate, inner portion darkest. T. a. line upright, slightly irregular, outer portion of line darker and heavier than the inner, included space concolorous. T. p. line exserted over reniform, strongly incurved below, narrowing the median space by one-half, inner portion of line darkest and broadest. S. t. line narrow, pale, partly obsolete, marked by three preceding and one following sagittate black dashes which define the distinct W. A row of small, terminal dark lunules. Claviform concolorous, outlined in black, extending nearly or quite across the median space. Orbicular large, round, bluish white, with narrow black outline. Reniform moderate, upright, hardly constricted, concolorous. An oblique, bluish-white shade through s. t. space, distinct at apex and hind margin, else obsolete. Secondaries smoky fuscous. Beneath pale, powdery, with exterior common line and discal dots. Head and thorax concolorous with primaries, with white admixture, the collar with a black line.

Expands 32<sup>mm</sup> (1.28 inches).

HABITAT.—“Middle States,” Maryland, Florida.

A single specimen from Maryland (J. B. S.) is in the Museum collection. Mr. Grote gives Middle States as locality for the species. Guenée and Walker both give Florida as localities for their types. The synonymical reference above follows Mr. Grote, but the description of *Raphia propulsa* disagrees utterly with what I have identified as Guenée's species. I have not seen any specimens labeled by Mr. Grote, and therefore do not know how he has identified it. I have seen a very few specimens agreeing with the figure in drawing and color, and with the brief comparative description as well; but I do not see how even Walker could have made such a description as his from the present species. The reference by Messrs. Grote and Robinson was made after an examination of types, and must be accepted as correct until some one equally competent can make the same comparisons.

The thorax is rather short, not strongly tufted, abdomen almost untufted. The primaries have the apices somewhat acute, outer margin obliquely rounded.

The harpes in the male have the tip dilated and obliquely drawn out superiorly. At inner margin, just below tip, is an acute, short, dentiform process. The inner face of the dilated tip is spinulose. The clasper is very stout, rather short, hardly curved, beak-like.

*Mamestra vittula* Grt.

1882. Grt., Trans. Kans. Ac. Sci., VIII, 48; *Mamestra*.

Ash gray, powdered, median space darker. Transverse lines geminate, black, included spaces pale. Basal line distinct, angulated. Median lines unusually approximated. T. a. remote from base, outwardly oblique, and very slightly irregular. T. p. almost parallel with outer margin, slightly sinuate, but not strongly incurved below reniform.

Orbicular small, round, gray, with dark center. Reniform moderate, pale. Claviform small, barely outlined. S. t. line narrow, pale, hardly defined, with a distinct though not well-defined W on veins 3 and 4. Secondaries white, veins slightly soiled. Beneath, whitish, powdered near costa, with an indefinite common line.

Expands 30<sup>mm</sup> (1.20 inches).

HABITAT.—New Mexico.

The species is not in the Museum collection, and I have seen only a single male specimen, marked "type" by Mr. Grote. It seems to me much more nearly allied to *capsularis* than to *4-lineata*, to which Mr. Grote compares it, but it is not likely to be confounded with either.

The harpes of the ♂ are long, slender, curved, abruptly and greatly dilated at tip, where it is inwardly fringed with a row of spinules. From base of the harpes arises the rather short, corneous clasper, which divides so that the prongs form a right angle at their point of junction.

*Mamestra prodeniformis* Smith.

1887. Smith, Proc. U. S. Nat. Mus., ix, 464; *Mamestra*.

Fuscons ashen gray, with a paler tinge in basal space, and a distinct, pale bluish shade through s. t. space; t. a. line single, upright or slightly oblique inwardly black, not attaining costa; t. p. line barely traceable, almost upright or very slightly sinuate, blackish, single; s. t. line yellowish, well marked with a prominent W, preceded by sagittate black dashes. A row of terminal black lunules. Claviform narrow, outlined in black, a fine black line crossing from its tip to the t. p. line. A pale shade surmounts this spot and crosses the median space. Orbicular narrow, oblique, pale ringed. Reniform lunate, superiorly a little paler, inwardly marked with black. Cell between the ordinary spots dusky. Secondaries white, with soiled outer margin. Beneath, powdery, without markings.

Expands 30–35<sup>mm</sup> (1.20 to 1.40 inches).

HABITAT.—Southwest Arizona, New Mexico.

One specimen, New Mexico (J. B. S.), collected by Professor Snow, is in the Museum collection.

The male of this species was mistaken by Mr. Grote for the male of his *Admetovis oxymorus*, and the generic character based on the difference in length of ♂ and ♀ antennæ has no existence. In type of maculation and in habitus this species bears a very obvious resemblance to Mr. Grote's species, but it lacks the distinct yellowish shades of that species. The present form is easily distinguished by its strong resemblance to *Prodenia*, in color as well as markings.

The sexual structure of the male is remarkably like that of *liquida*. The clasper is a little more prominent, and the tip of the harpes is a little more drawn out—else they agree.

*Mamestra atlantica* Grt.

1874. Grt., Buff. Bull., II, 12; *Mamestra*.  
 1875. Grt., Check List, p. 7; *Mamestra*.  
 1881. Grt., Can. Ent., XIII, 128, ♀ = *dissimilis*.  
 1889. Butler, Trans. Ent. Soc. Lond., 385 = *dissimilis*.  
*W-latinum*, Gn.  
 1852. Gn., Sp. Gen. Noct., II, 105; *Hadena*.  
 1874. Grt., Buff. Bull., II, 12; pr. syn.  
*dissimilis*, var. *discolor*; Speyer.  
 1875. Speyer, Stett. Ent. Zeit., 36, 142; *Mamestra*.  
 1881. Grt., Can. Ent., XIII, 128; pr. var.  
 1882. Grt., New List; pr. syn.

Red or fuscous brown, terminal space darker, costal space paler, often irrorate with whitish. Transverse lines more or less completely obsolete, never entire; t. a. line, when traceable, marked with white scales, lunate between the veins; t. p. line similarly marked, lunulate, and parallel with outer margin; s. t. line distinct, pale or white, with prominent white W on veins 3 and 4, preceded by a dusky shade and black dashes. A row of distinct black terminal lunules. A basal black streak, almost attaining t. a. line. Claviform rather large, concolorous, outlined in black. Orbicular oval oblique, rather large, outlined in black, then with a pale annulus; center concolorous or strongly white marked. Reniform rather large, annulate, and defined like the orbicular, concolorous, inferiorly somewhat dark stained, the shade extending beyond the reniform to the t. p. line. A more or less definite pale shade from apex through s. t. space. Vein 2 is often thoroughly powdered with white through median space. Internal vein often white marked throughout its course. Secondaries fuscous, smoky, paler toward base. A distinct discal lunule. Beneath, reddish, powdery, with distinct common line and discal spots. Head and thorax concolorous with primaries; a distinct black transverse line on collar; patagiæ often marked with black. Thoracic tufts low, but distinct; abdominal tufts small.

Expands 30–35 mm (1.20 to 1.40 inches).

HABITAT.—Canada, Atlantic States to Virginia, west to Wisconsin.

Six specimens are in the Museum collection; localities as follows: Wisconsin (Meske); Orono, Maine (J. B. S.); Schenectady, New York, July 28 (C. V. R.); Albany, New York, August 28 (Meske); Adirondack Mountains (U. S. N. M.).

Mr. Grote never really described this species, but I have seen a number of specimens labelled by him, one of them now in the Museum collection. Guenée mentions a form of *W-latinum* as from America, and Mr. Grote (Buff. Bull., II, 12) simply gives the name *atlantica* in his list, with *W-latinum* as a synonym. In the check list of 1875 there are a few lines in note 6, which give none of the characters, and there is nothing else even pretending to a description.

Speyer, in comparing a series of American specimens with the Euro-

pean *dissimilis*, concludes that they are identical, but considers the American form sufficiently distinct to be called *discolor*. Finally, Butler (in the Trans. Ent. Soc. Lond., for 1889) unqualifiedly makes *atlantica*=*dissimilis*. I have not had an opportunity of examining the sexual characters of the European form, and the resemblance, superficially, does not strike me as sufficiently marked to induce me to follow the references made. In this series there is no strong resemblance in the sexual characters, and if the European form on study shows the same structure I should be ready to admit their identity. The insect varies somewhat. One form is almost evenly brown, the maculation, however, obvious; another is very strongly irrorate with white, and decidedly distinct from the normal form while yet retaining its essential characteristics.

The species is not uncommon, and differs from all the preceding in color and maculation. The black basal streak, incomplete transverse lines, and large claviform all are distinctive; so also are the primaries by their somewhat retreating hind angle. The genitalia of the male are distinctive. The harpes are broad, semi-chitinous, curved, at tip formed into a rather small, acute hook. From the superior portion of this piece and near the tip arises a moderate, curved, corneous hook, parallel to but longer than the terminal hook; near the base arises a much stouter and longer corneous hook, curved in the opposite direction, so that the points of the two last-mentioned hooks are opposed to each other. The structure is best shown by a reference to the figure.

*Mamestra desperata*, sp. nov.

Ground color a somewhat faded red brown, washed with grayish, which is more distinct in the median space. Collar with a prominent black transverse line. Thoracic and abdominal tuftings distinct. Primaries with a short, very distinct basal black dash. Basal half line geminate, inner line black, outer brown, included space gray. T. a. line geminate, distinct, more strongly marked on costa, only a little oblique outwardly and but little outcurved between the veins. T. p. line geminate, included space gray, defining lines not well marked, the inner brown and lunulate. As a whole, well outcurved over the cell and obliquely inward beneath, nearly parallel to outer margin. S. t. line narrow yellowish white, obsolete on costa, but very distinct thence; a prominent W mark on veins 3 and 4. The line is preceded by rusty brown scales, forming an obvious shade in the submedian interspace. A series of brown terminal lunules, fringes cut with yellowish on the veins. A distinct red brown median shade outwardly oblique between the ordinary spots, inwardly angulate on vein 2. Claviform concolorous, small, outlined by black scales. Orbicular irregularly oval, outlined by black scales, annulate with gray, otherwise concolorous. Reniform large, upright, kidney-shaped, black ringed, outwardly shaded with yellowish. Secondaries smoky fuscous with darker discal spot

and pale fringes. Beneath, reddish, powdery, primaries smoky on disc, with an evident outer line and discal spot on all wings.

Expands 37<sup>mm</sup> (1.50 inches).

HABITAT.—New Hampshire, Maine, Sierra Nevada, California.

Three specimens are in the Museum collection: Maine (J. B. S.); Nevada County, California, red number 341 (through C. V. R.). Mr. Edwards has the species from Sierra Nevada.

Long ago Mr. Thaxter gave me a specimen of this species named *dimmocki*, the determination, as I understood, by Mr. Grote. I have so named it in the collection of the U. S. National Museum, in Mr. Edwards's collection, and perhaps in others. In comparing specimens with the original description I find that it does not agree at all. *Dimmocki* is compared with *subjuncta*, and it is expressly stated that the s. t. line is straight and that there is no W mark.

The present species is allied to *atlantica* in appearance, but is much more even in color, the black basal dash being the only decided marking.

In the sexual characters of the male the species is unique. The harpes are broad, somewhat curved, the tip superiorly prolonged in a finger-like process. The clasper is a broad, flat process, rounded at tip from the middle of the harpe.

The species is not common and is apparently a northern or mountain form. It should not be difficult of recognition from its resemblance to *atlantica*.

• *Mamestra canadensis* Smith.

1837. Smith, Proc. U. S. Nat. Mus., x, 464; *Mamestra*.

Dull sordid fuscous brown; a pale, more yellowish red shade at base superiorly, in median space beyond claviform, and from the reniform outward. Transverse lines evident, geminate. Basal line obscured by the pale shade, which is inferiorly limited by a fine black longitudinal line. T. a. line lunate, the included space marked with white scales. T. p. line sinuate, parallel to the very oblique outer margin; not very distinctly marked. S. t. line narrow, white, interrupted, the W mark prominent. An irregular dusky shade and spots mark both sides of the line. Claviform concolorous, large, broad, extending almost across the median space. Orbicular oblique, ovate, black ringed, paler than the ground color. Reniform very large, outwardly indefinite, and invaded by a pale shade which extends toward and is lost in the ground color before it reaches the apex. The head and collar inferiorly are pale; collar superiorly and thorax of ground color of primaries. Secondaries dirty gray. Beneath, obscure fuscous gray, powdery.

Expands 37<sup>mm</sup> (1.48 inches).

HABITAT.—New Brunswick.

I have seen only a single male specimen, in rather poor condition, from Mr. Thaxter's collection. It is like *subjuncta* in wing form, and

similar to it also in maculation, but still more like the description of *nevadæ*, with which it can hardly be identical. In genital structure it is like *atlantica*. The harpes are modified toward tip into a curved hook, longer than in *atlantica* but of the same shape; three smaller corneous hooks of various shapes arise from the inner face of the harpe, that nearest base the longest.

*Mamestra nevadæ* Grt.

1876. Grt., Buff. Bull., III, 84; *Mamestra*.

“♀. Smaller than *lubens*; between this species and *subjuncta*. Dark blackish brown, shaded with light red-brown, or leather brown at base above the basal dash and beyond the reniform, and again below vein 2 over subterminal space. Claviform small, concolorous; orbicular pale, small; reniform large, shaded outwardly with light brown. Median lines as usual; subterminal near the margin, distinct, white, with prominent W mark. Hind wings blackish fuscous without marks. Beneath, concolorous blackish fuscous with dot on secondaries. Thorax blackish, tufted. Eyes hairy.”

“Expanse 36<sup>mm</sup>. No. 4582, Mr. Hy. Edwards, Sierra Nevada, California.”

In Mr. Edwards's collection is an imperfect specimen with this name, and agreeing, so far as the maculation is traceable, with the above description. The specimen, however, has naked eyes, and is an *Hadena* allied to *curvata*. The insect was so determined by Mr. Grote; but as it is not good enough to compare with all the details of the description, it is retained here as unknown. Mr. Butler (in the Trans. Ent. Soc. Lond., for 1889, p. 385) refers this species to *thalassina* Hbn.; but as the reference is not accompanied by a critical comparison of the species, I prefer not to accept it at present. It may be worthy of note that Speyer (in Stett. Ent. Zeit. 36, 140) speaks of a specimen supposed to be American, but without definite locality, expanding 36 millimetres, and differing only in minor details from the European *thalassina*.

*Mamestra subjuncta* G. and R.

1868. Grt. and Rob., Trans. Am. Ent. Soc., II, 198, Pl. 3, f. 71; *Hadena*.

1873. Riley, 1st Rept. Ins. Mo., 84, Pl. 1, ff. 14-17; *Hadena*.

1873. Grt., Buff. Bull., I, 282; *Mamestra*.

1874. Grt., Buff. Bull., II, 12; *Mamestra*.

1875. Speyer, Stett. Ent. Zeit., XXXVI, 138; *Mamestra*.

Dark fuscous brown; a reddish shade above basal black streak and beyond reniform. T. a. line complete, geminate, narrow, lunate. T. p. line faintly geminate, obsolete superiorly, strongly incurved below reniform, not much more, however, than the incurve of outer margin. S. t. line distinct, with prominent W-mark, the angles marked by black points. A row of terminal lunules. A black basal streak, not attaining t. a. line. Basal line indicated on costa. Claviform large,



concolorous, outlined in black, the line forming its inferior margin prolonged across the median space and connecting the median lines. Orbicular round, moderate in size, reddish, black margined. Reniform kidney-shaped, also narrowly bordered with black; a rufous suffusion and central dusky shade. Secondaries fuscous, basally paler. Beneath, powdery, with common outer line and discal dot; primaries shaded with reddish. Head and thorax like primaries, collar with a black line.

Expands 38–42<sup>mm</sup> (1.52 to 1.68 inches).

HABITAT.—Canada, Eastern and Middle States, Ohio, Minnesota, Nebraska.

Six specimens in the Museum series, others in the duplicate collections. The localities are: Albany, New York, June 2 (Meske); Ohio, West Point, Nebraska, June (U. S. N. M. Coll.).

Distinct from all others by the uniform coloration, combined with the obvious transverse mark between median lines. The genitalia are essentially as in *liquida*. The harpes are angulate, the angle inferiorly prominent, tip strongly dilated, rounded, inwardly spinulose. Clasper consisting of two small curved hooks, one of them with dilated tip.

Speyer thinks that Guenée had this species before him when he referred to *W-latinum* as American, and professes himself unable to understand what Grote's *atlantica* represents. I think Speyer is right in supposing that Guenée had *subjuncta* before him, and as *atlantica* has not been sanctioned by a proper description it should, strictly, be cited as a synonym to this species. But as the species have become well known under the Grotean terms it would only introduce confusion were they changed now.

#### *Mamestra grandis* Bois.

1840. Bois., Gen. et Ind. Meth., 120, No. 950; *Hadena*.

1841. Guen., Noct. Ind. Meth., 244; *Hadena*.

1852. Guen., Sp. Gen. Noct., II, 105; *Hadena*.

1857. Wlk., C. B. Mus., Lep. Het. XI, 578; *Hadena*.

1857. Led., Noct. Eur., 90; *Mamestra*.

1883. Thaxter, Papilio III, 17; *Mamestra*.  
*libera* Wlk.

1856. Wlk., C. B. Mus., Lep. Het., IX, 179; *Xylophasia*.

1882. Grt., Ill. Essay, 44; pr. syn.

Fuscous, somewhat reddish brown; somewhat irrorate with bluish gray; a distinct bluish-white shade through s. t. space, the outer margin of which is rigidly oblique; inwardly it shades to the t. p. line. Transverse lines usually completely traceable, indistinctly geminate, the included space pale. T. a. line outwardly scalloped between the veins. T. p. line lunulate, about parallel with the outer margin. A basal dark streak, above which the space to costa is somewhat paler. Median space often with a reddish cast; usually the internal margin somewhat irrorate with bluish gray. Claviform absorbed in a brownish-black streak which connects the transverse lines. Orbicular rather large,

round, somewhat paler than ground color, defined by a narrow black line. Reniform large, normal in shape, paler than orbicular, but with a fuscous median shade. S. t. line very distinct, yellowish, with prominent W-mark, inwardly shaded with umber brown and small black spots to the pale shade, outwardly irregularly shaded with black and brown. Secondaries sordid smoky fuscous. Beneath, with a reddish shade, powdery, with dusky transverse lines and discal spot. Head and thorax concolorous with primaries, tuftings distinct. Abdomen concolorous with secondaries, with distinct dorsal tuftings.

Expands 38-42 mm (1.52 to 1.68 inches).

HABITAT.—Greenland, Lapland, Canada, Maine to Pennsylvania, west to Illinois, Wisconsin, Minnesota.

Six specimens are in the Museum series; localities as follows: Wisconsin (Meske); New Hampshire (J. B. S.); Illinois, October 29 (C. V. R.).

The Arctic localities are given by Walker, who, *vide* Grote, re-described the species, giving New York as the locality. Boisduval described the species as European; but Guenée declares this an error, and says the specimen is really American.

In all habital features this species is a close ally of *subjuncta*, than which it is larger, and from which it differs in the pale s. t. shade which forms a prominent feature in the appearance of the insect.

The genitalia also clearly resemble those of *subjuncta*, but the clasper is small, single and acute.

Mr. Thaxter has bred the larva on burdock.

*Mamestra invalida*, sp. nov.

Dark ashen gray, all the lines distinct. Head darker, more smoky. Collar with a distinct black median line. Patagiæ with a somewhat indefinite black submarginal line. Abdominal tufts prominent. Basal half line geminate, distinct, included space strongly white powdered. T. a. line distinct, geminate; inner line faint; outer line distinct, black, outcurved between the veins, as a whole a little outwardly oblique. T. p. line geminate; outer line vague, diffuse; inner line distinct, black, lunulate, outcurved over reniform and strongly incurved below, narrowing the median space. S. t. line white, distinct, irregular, with a well-defined W-mark on veins 3 and 4. A blackish cloud precedes and follows the line in the submedian interspace and follows it on vein 5. A row of black terminal lunules. Fringes dark, cut with white on the veins. A dusky cloud through the basal space. A distinct median shade line between the ordinary spots, then close to the t. p. line, reaching the inner margin at almost the same point. S. t. space grayish white powdered, decidedly yet not prominently paler than the remainder of the wing, more dusky on costa, veins marked with blackish. Claviform small, black margined, pale powdered, a black line from its outer extremity extending to the t. p. line. Orbicular rather small,

round or oval, concolorous, ringed with whitish. Reniform large, kidney-shaped, pale ringed and with a paler central lunule, else concolorous. Secondaries uniform smoky fuscous, with an evident darker discal lunule; the veins also darker. Beneath, gray, powdery, both wings with a black extra discal line and discal spot.

Expands 44<sup>mm</sup> (1.75 inches).

HABITAT.—Sierra Nevada, California; Placer County, California.

In the Museum collection are three female specimens marked June, Placer County, California (through C. V. R.), red number 308.

From Mr. Edwards I have specimens marked Sierra Nevada, also all females.

The species has somewhat the habitus of *lubens*, and much of its general style of maculation. The distinct white s. t. line with the prominent W-mark affords an easy distinctive character.

***Mamestra trifolii* Rott.**

1776. Rott., *Naturf.*, ix, 131; *Noctua*.  
*chenopodii* Fabr.  
 1787. Fabr., *Mant. Ins.*, ii, 146; *Noctua*.  
 1791. Oliv., *Encycl. Meth.*, viii, 303; *Noctua*.  
 1793. Fabr., *Ent. Syst.* iii, 2, 68; *Noctua*.  
 1793. Gmel., ed. xiii, *Linu. Syst. Nat.*, 2542; *Noctua*.  
 1816. Hubn., *Verzeichniss*, 219; *Diataraxia*.  
 1852. Gn., *Sp. Gen. Noct.*, ii, 97; *Hadena*.  
 1857. Wlk., *C. B. Mus.*, *Lep. Het.* xi, 570; *Hadena*.  
 1881. French, *Can. Ent.*, xiii, 23, larva on *Chenopodium*.  
 1881. Coq., *Papilio* i, 7; *Mamestra*.  
*albifusa* Wlk.  
 1857. Wlk., *C. B. Mus.*, *Lep. Het.* xii, 753; *Hadena*.  
 1873. Grt., *Buff. Bull.*, i, 104; *Mamestra*.  
 1875. Speyer, *Stett. Ent. Zeit.*, xxxvi, 202; pr. syn.  
 1881. Grt., *Can. Ent.*, xiii, 128; pr. syn.  
*oregonica* Grt.  
 1881. Grt., *Can. Ent.*, xiii, 230; *Mamestra*.  
*major* Speyer.  
 1875. Speyer, *Stett. Ent. Zeit.*, xxxvi, 138; *Mamestra*.  
 1881. Grt., *Can. Ent.*, xiii, 128; *Mamestra*.

Pale to fusco-luteous; color even or irrorate. Transverse lines distinct, geminate. T. a. line with an even outward curve, but little lunate between veins. T. p. line finely lunate, slightly sinuate; more upright than outer margin. S. t. line distinct, pale, irregular, strongly angulate at inception over the somewhat paler apical spot, and with the usual W-mark distinct. Basal line geminate, distinct. Claviform rather variable in size, usually short and rather broad, powdered with black, always distinct. Orbicular moderate, round, concolorous or slightly paler, black-margined. Reniform large, distinctly outlined, dusky inferiorly darker. S. t. line preceded by more or less evident black sagittate dashes. A row of black terminal lunules. Antennæ of male moderately ciliated. Secondaries fuscous or yellowish, with dark

outer borders and pale fringes. Beneath, powdery, markings of secondaries more or less distinctly reproduced. A variably distinct outer line and discal spots. Head and thorax concolorous with primaries.

Expands 30 to 37<sup>mm</sup> (1.20 to 1.48 inches).

HABITAT.—Europe and North America.

The Museum series contains twelve specimens, and others are among the duplicates. The localities are: Albany, New York, May 18, June 16, August 9, 12 (Meske, C. V. R.); Boston, Massachusetts (J. B. S.); District of Columbia, May 22; Central Missouri, May 18, June 2 and 30 (C. V. R.); Denver, Colorado, Bruce (Coll. U. S. N. M.); New Jersey, Iowa, northern Illinois, Arizona.

A widely distributed and very common species, which is readily recognized by the large reniform, which is inferiorly darkish, as well as by the usually gray luteous color of primaries. It can not be confused with any other of the species with prominent W-mark to s. t. line.

The type form is rather pale luteous, very strongly frosted or powdered with gray; the maculation is all present, but is obscure and not contrasting. This is the common eastern form.

*Marmorosa* is applied to an even luteous form with very distinct maculation, the black dashes preceding s. t. line being especially prominent. It is a European form and occurs again in Arizona. I have not seen it from any eastern locality.

*Oregonica* is densely powdered with fuscous, the markings hardly relieved; secondaries distinctly yellow tinged. This is from Mt. Hood and may be like *microdon* Gn., which Standinger cites as an aberratic variety from the Alps and (?) Labrador, and of which he says "multo obscurior."

The genitalia of the male are very strongly marked. The harpes are membranous, broad at base, suddenly and strongly constricted into a narrow, short, curved neck, which dilates at tip into a rounded, concave lappet, fringed inwardly with a row of spinules. The clasper is very stout, chitinous, and of an almost indescribable form. A reference to the figure must serve in lieu of words.

This insect is of economic importance and the life history has been written in economic publications by Dr. Riley and others. I have not included these economic references, nor have I made any attempts at giving the European bibliography.

#### Group VINDEMIALIS.

The species here associated agree in color and general habitus only, and the group is easily characterized as consisting of rather large red or blackish-brown species which do not by structural peculiarities belong to other groups.

They are all rather robust in build, with moderately large wings, rather roughly clothed and indistinctly tufted thorax, and more or less incomplete maculation. The species are easily distinguished.

*U-scripta* is darkest, blackish brown in color, the reniform inferiorly outlined in white, forming a distinct U.

*Rosea* is the only species in which all the lines are present; they are single, darker brown than ground color, and the ordinary spots are concolorous. The thorax is deeper red brown and like the following.

*Congermana* lacks the transverse lines, but has the s. t. line indicated by white scales, and the ordinary spots, though not defined, yet well marked by white patchy spots.

*Vindemialis* is almost immaculate rather dark red-brown, a few white scales barely indicating the ordinary lines and spots. Practically the wings may be said to be immaculate.

*Picta* is an aberrant species, and almost entitled to form a separate group. The wings are more pointed and narrower than in any of the preceding. The primaries are carmine shaded, and the secondaries are white. The transverse maculation is wanting and the ordinary spots are large and very irregular, powdery and not distinctly outlined. The genitalia are also very different from any of the preceding.

In tabular form the species may be separated as follows:

Apices of primaries rectangular; secondaries dusky.

Blackish brown, all the maculation obsolete, reniform inferiorly white lined.

.....U-SCRIPTA

Reddish or red-brown.

Transverse lines darker brown, distinct, single. Ordinary spots concolorous, outlined in dark brown.....ROSEA

Transverse lines obsolete.

Ordinary spots and usually s. t. line indicated by pale blotches or scales.

.....CONGERMANA

Maculation all obsolete.....VINDEMIALIS

Apices of primaries produced; secondaries white.

Crimson brown red; maculation obsolete; ordinary spots indistinctly marked, paler, reniform irregular.....PICTA

#### Mamestra u-scripta, sp. nov.

Head and thorax dark blackish brown, powdery. Primaries a very slight shade paler, powdered by a few whitish scales along costal and inner margin. Veins black marked, with occasional white scales intermixed, the fringes cut with white, opposite. All the transverse maculation obsolete, except for a black terminal line followed by a yellowish line at base of fringes. Orbicular wanting. Reniform concolorous, the lower edge white marked, forming an irregular U or V. Sometimes a few white scales indicate the upper portions of the spot, but as a rule the upper part is entirely unmarked. Secondaries smoky brown with a small darker discal lunule, and a dark followed by a pale terminal line. Beneath, pale, powdered with black. A dusky outer line and a distinct discal lunule on all wings.

Expands 39–41<sup>mm</sup> (1.56 to 1.64 inches).

HABITAT.—Sierra Nevada, California; Nevada County, California.

I have received this from Mr. Edwards, and there are two female specimens in the National Museum (through C. V. R.), which bear

the red number 344, indicative of a biological note in Dr. Riley's possession.

The species is robust in habitus, and utterly unlike anything else known to me in this genus. Altogether there are four specimens in the Museum collection, my types being also deposited there. The sexual characters of the male are distinctive, yet show a decided resemblance to *vindemia*, differing obviously in the shape of the clasper.

*Mamestra rosea* Harv.

1874. Harvey, Buff. Bull II, 119; *Mamestra*.

Reddish testaceous, powdery, rather evenly colored to s. t. space, which outwardly becomes deep red brown, and by its contrast with the evenly ferruginous terminal space marks the course of the very irregular s. t. line. Transverse lines single, brown. Basal line distinct. T. a. line outwardly oblique and irregularly curved and sinuate. T. p. line crenulate, about parallel with the outer margin. An angulated brown shade through the outer portion of median space. Ordinary spots brown ringed; orbicular small, round, concolorous; reniform upright, inferiorly marked with blackish. Claviform brown margined, else concolorous. Secondaries pale, with a faint yellowish red tinge, more reddish fuscous outwardly, fringes pale. Beneath, pale, with carmine powderings outwardly. A common outer line and distinct brown discal lunules. Head, thorax, and basal tuft of abdomen deep red-brown. Abdomen concolorous with primaries. Beneath, vestiture with a carmine tinge.

Expands 40–43<sup>mm</sup> (1.60 to 1.72 inches).

HABITAT.—Canada, Eastern and Middle States.

Six specimens are in the collection, others in the duplicate series; localities as follows: Center, New York, May 12 and 14 (C. V. R.); same locality, May 24 (Meske); Maine (C. V. R.); New Hampshire (J. B. S.).

Easily recognized by the color and distinct, simple maculation. The harpes are broad at base, constricted and angulated near tip, where it is again enlarged into a circular concave lappet, fringed at inner side with spinules. The clasper consists of a slightly emarginate, broad, corneous process, produced superiorly into a long curved hook. The insect is rather northern in habitat and is not common.

*Mamestra congermana* Morr.

1874. Morr., Can. Ent., VI, 106; *Hadena*.

1878. Grt., Bull. U. S. Geol. Surv., IV, 187; *Mamestra*.

1880. Grt., Bull. Bkln. Ent. Soc., III, 39; *Mamestra*.

Yellowish red brown, often with a carmine tinge. Transverse lines obsolete or faintly indicated by small white venular dots. S. t. line more completely indicated by a narrow, irregular, interrupted testaceous shade. Ordinary spots white marked. Orbicular small, round; reniform large, white, with brownish central lines. Secondaries pale

yellow fuscous, outwardly darker, fringes with a carmine tinge. Beneath, pale yellow fuscous with dense carmine powderings toward costal and outer margins. Head, thorax, and basal tuft of abdomen concolorous with primaries. Abdomen like secondaries, often with a carmine tinge.

Expands 33–38<sup>mm</sup> (1.32 to 1.52 inches).

HABITAT.—Northern, Eastern, and Middle States; Colorado.

Six specimens are in the Museum collection: New York (J. B. S.); Center, New York, May 15, 26 (Meske); Colorado, from Bruce. The Colorado examples are paler in ground color, more as if a film of white underlaid the normal tinting. The species is easily recognized by the characters given. The harpes of male are narrowed and angulate near tip, where they are, as usual, broadly dilated and spinulated. There seems no distinct clasper, though there is a slight projecting angle of the harpe, which might serve as such.

This species is also quite uncommon in collections.

**Mamestra vindemialis Gn.**

1852. Gn., Sp. Gen. Noct., 1, 344; *Ceramica*

1857. Wlk., C. B. Mus., Lep. Het., x, 417; *Ceramica*.

1875. Grt., Proc. Ac. Nat. Sci., 413; *Mamestra*.  
*rubefacta* Morr.

1874. Morr., Can. Ent., vi, 251; *Ceramica*.

1880. Grt., Can. Ent., xii, 185; pr. syn.

1881. Grt., Can. Ent., xiii, 128; pr. syn.

Dark red-brown, with a more or less distinct carmine tinge. The veins slightly darker, with sparse white powderings. Transverse lines marked by venular whitish dots. S. t. line marked on costa only by white powderings. Ordinary spots small, dusky, indefinite, with a few white scales. Secondaries pale yellow fuscous with darker outer margin. Beneath, powdered with carmine toward outer and costal margins. Head and thorax concolorous with primaries, abdomen with secondaries.

Expands 37–40<sup>mm</sup> (1.48 to 1.60 inches).

HABITAT.—Canada, Eastern and Middle States, Florida.

Four specimens are in the collection: New York (J. B. S.); Center, New York, May 14 and 21 (Meske).

The Florida record is by Guénéé. I have not seen southern specimens myself.

The species is easily recognized by the uniform deep red-brown color, with all the maculation subobsolete and indicated in the most incomplete manner. In this and all the preceding species of the group, the abdomen is laterally tufted and there is an agreement in stout fascies.

The male has harpes much as in *congermana*, but the inner margin of tip is more drawn out. The superior margin is somewhat rolled, thickened, and produced into a curved hook.

**Mamestra picta** Harr.

1847. Harris, Rept. Ins. Mass., 329; *Mamestra*;  
1362. Harris, Injurious Insects, Flint ed., 452; *Mamestra*.  
1370. Riley, 2 Rept. Ins. Mo., 112, f. 82; *Mamestra*.  
1872. Lintner, Ent. Cont., III, 137; *Mamestra*.  
1882. Grt., Papilio, II, 99; *Mamestra*.  
*exusta* Gn.  
1852. Gn., Sp. Gen. Noct., I, 344; *Ceramica*.  
1857. Wlk., C. B. Mus., Lep. Het., x, 417; *Ceramica*.  
1874. Grt., Buff. Bull., II, 22; pr. syn.  
*contraria* Wlk.  
1856. Wlk., C. B. Mus., Lep. Het., ix, 78; *Mythimna*.  
1368. Grt. and Rob., Trans. Am. Ent. Soc., II, 77; pr. syn.  
1882. Grt., Ill. Essay, 41; pr. syn.

Deep red-brown toward costal region, with a carmine tinge. Transverse lines obsolete. S. t. line imperfectly indicated by yellowish scales, most strongly marked near hind angle. Claviform imperfectly marked by yellowish scales. Orbicular rather small, rounded, with annulus composed of yellow scales. Reniform large, irregular, variable, usually with the inferior angle produced inwardly, and irrorate with reddish scales. Secondaries white, outer margin slightly powdery, a brownish red terminal line. Beneath, pale, with margins strongly powdered with carmine. Head and thorax concolorous with primaries.

Expands 35-45<sup>mm</sup> (1.40 to 1.70 inches).

HABITAT.—Canada to Virginia, west to Nebraska, Wisconsin.

Six specimens are in the study collection, others in the duplicate series. The localities are: New York, August 29 (J. B. S.); Evans Center, New Jersey, July, A. R. Grote, collector (C. V. R.); Maine (C. V. R.).

The species is sometimes common and of economic importance, and its bibliography in economic literature is given by Henry Edwards in Bulletin 35 of the U. S. National Museum.

The primaries are narrower and the apices more acute than in any other species in this group, and the white secondaries are also distinctive. The sexual characters of the male are peculiar. The harpes are corneous, broad, drawn out to an acute point, and furnished with a small pad which is densely pubescent. Inferiorly, near the tip, is an obtuse and then an acute dentiform process, while near the base there is a strongly curved, oval, hoop-like process. The figure on plate will be the best explanation of the description.

**Mamestra u-album** Gn.

1852. Gn., Sp. Gen. Noct., I, 345; *Ceramica*.  
1857. Wlk., C. B. Mus., Lep. Het., x, 417; *Ceramica F-album*.  
1874. Grt., Buff. Bull., II, 22; *Ceramica W-album*.

35 millimetres. Primaries of a violet gray, with the disc and terminal space a deep wine-brown, and the reniform spot neatly cut



inferiorly with pure white filled with gray above; orbicular reduced to a white point. T. a. line distinct, strongly sinuate. T. p. line lost in the brown, except inferiorly, where it forms an angle well marked on the submedian vein. S. t. line distinguished solely by the difference in tints. Secondaries of a deep gray, with the fringe pale rosy. Beneath, glossy, shining, of a pale carneous gray with traces of a line, but without discal spot. Thorax deeper in color.

HABITAT.—Florida (Doubleday).

The above is a free translation of Guenée's description, which I can not at present apply with any certainty. The curious change of name, entirely destroying the meaning the author intended to convey, has been already referred to. The reference to *Mamestra* has been made by Mr. Grote in his lists, assuming that the species is congeneric with *picta*.

#### Group LATEX.

Rather large species, with rather narrowly trigonate primaries, somewhat produced or rectangular apices, oblique outer margin, and somewhat retreating hind angle. The antennæ are simply ciliated in the male. Body and abdominal tuftings usually distinct and sometimes rather prominent. No very close relationship exists between the forms associated in this group, which in that respect shares the fate of the preceding.

*Cristifera*, which on Mr. Butler's dictum replaces *lubens*, stands by itself. The dark ground color, contrasting reniform, and bluish irroration in s. t. space, render this species recognizable at a glance.

*Assimilis* is also singular. Its deep black ground color, the velvety lines and borders to the ordinary spots, and the punctiform, white s. t. line—the spot nearest internal angle most prominent—form an aggregation of characters that is peculiar.

*Latex* is a very pale form, with large ordinary spots, the reniform red marked, and the s. t. line very irregularly and strongly angulate and sinuate. The male organs have a surprisingly varied assortment of hooks and claspers.

*Passa* seems allied to *latex*, and is, like it, pale in color, but smaller in size. The even s. t. line readily separates it. The ♀ only has thus far been examined.

In tabular form the species separate as follows:

Outer margin of primaries not distinctly dentate.

Large, dark blackish gray, with a violaceous powdering; reniform upright, pale, contrasting; s. t. space with prominent violaceous shadings.....CRISTIFERA.

Smaller, black; lines fine velvety black, as are also the outlines of ordinary spots; s. t. line white, punctiform, a prominent white spot near hind angle...ASSIMILIS.

Outer margin of primaries dentate, hind angles more evidently retracted; wings narrower.

Color pale; ordinary spots large, distinct; reniform with a reddish shade; s. t. line very irregularly dentate.....LATEX.

Reniform without the reddish shade; s. t. line even, pale; size smaller....PASSA.

*Mamestra cristifera* Wlk.

1858. Wlk., C. B. Mus., Lep. Het., xv, 1654; *Acronycta*.  
1862. Grt., Ill. Essay, 33. An *Hadenid*.  
1869. Butler, Trans. Ent. Soc. Lond., 385; *Mamestra*.  
*lubens* Grt.  
1875. Grt., Trans. Am. Ent. Soc., v, 113; *Mamestra*.  
1875. Grt., Proc. Acad. Nat. Sci. Phila., 425; *Mamestra*.  
1875. Morr., Proc. Bost. Soc. Nat. Hist., xviii, 118; *Mamestra*.  
1881. Grt., Can. Ent., xiii, 127; *Mamestra*.  
1889. Butl., Trans. Ent. Soc. Lond., 385; pr. syn.  
*rufula* ♀ Morr.  
1875. Morr., Proc. Acad. Nat. Sci. Phila., 62; *Mamestra*.  
1875. Grt., Proc. Acad. Nat. Sci. Phila., 428; pr. syn.  
1881. Grt., Can. Ent., xiii, 127; pr. syn.  
*brassicæ* † Grt.  
1873. Grt., Buff. Bull., i, 103; *Mamestra*.  
1874. Grt., Buff. Bull., ii, 12; *Mamestra*.  
1875. Morr., Proc. Acad. Nat. Sci. Phila., 62; pr. syn.

Dark blackish gray, with a variably distinct rufous flush and bluish irrorations, forming a peculiar shade, hard to describe. Transverse lines present, geminate, but not very distinctly visible against the dark ground color. Basal line traceable. Basal space with a distinct rufous tinge. T. a. line with three subequal outward curves; included space bluish. T. p. line lunulate or crenulate, nearly parallel to outer margin. S. t. line yellow, marked with a few violet scales, irregularly sinuate, usually interrupted. An irregularly dentate line crosses median space between the ordinary spots. A row of black terminal lunules. Claviform moderate in size, distinctly outlined, concolorous. Ordinary spots distinct, moderate in size, black-ringed. Orbicular round, bluish gray, with darker center. Reniform upright, sometimes slightly constricted at middle, usually oblong, creamy yellow, occasionally with a reddish flush centrally, with a pale shade of ground color. The median space is variably—sometimes not at all—flushed with red, always with blue-gray powderings, which are most evident on costa and at inception of t. p. line. S. t. space most strongly powdered, a distinct patch opposite the cell, and another prominent and distinctive shade at the sinus of the t. p. line near hind margin. A sordid, rusty red shade precedes and marks the s. t. line, which is also marked by a blackish costal patch. Terminal space darker, apex strongly marked with blue scales. Secondaries smoky fuscous. Beneath, with carmine powderings and distinct dark outer line. Head and thorax concolorous with primaries. Dorsal thoracic tufts distinct, divided. Abdominal tufts rather prominent, especially on third and fourth segments.

Expands 40–48<sup>mm</sup> (1.60 to 1.92 inches).

HABITAT.—Hudson's Bay territory, Canada; Maine to Pennsylvania, west to the Mississippi.

Six specimens are in the study collection, others in the duplicate series. Localities: New York (C. V. R., J. B. S.); Albany, New York, May 30 (Meske); New Hampshire (J. B. S.).

A very well marked species, distinguished by large size, rather rough vestiture, prominent discolorous reniform, the blue patch near hind angle, and the rather prominent abdominal tuftings. It is not uncommon.

Mr. Grote, in 1831 or 1832, examined the type of *Acronycta cristifera* in the British Museum, and says of it (Ill. Essay, 38): "The type from Hudson's Bay is not an *Acronycta*. The abdomen is tufted; the species is dark stone-gray, with kidney-shaped reniform, and seems a Hadenoid form unknown to me."

Mr. Butler, in 1839, comparing the material in the Grote and Walker collections, refers *lubens* to *cristifera* without comment. The species is so strongly marked that error on Mr. Butler's part seems out of the question; but it seems almost equally improbable that Mr. Grote should not have recognized the species, which must be one of the most familiar to him. I have followed Mr. Butler, who has actually compared the species.

The harpes of the male are long, narrowing toward middle and widening toward tip, where it is obliquely drawn out above and truncate. Inwardly the tip is rather densely spinulated. The clasper is a single rather short, curved, corneous hook.

*Mamestra assimilis* Morr.

1374. Morr., Buff. Bull., II, 119; *Mamestra*.

1381. Goodell, Papilio, I, 15; larva.

*v. pulverulenta* Smith.

1387. Smith, Proc. U. S. Nat. Mus., x, 468; *Mamestra*.

Glossy black. Transverse lines faintly marked, single. T. a. upright, slightly sinuate. T. p. nearly parallel with outer margin, indistinctly crenulate. S. t. line white, punctiform, the pale points marked with more intensely black shades; a prominent white blotch at hind angle. Ordinary spots outlined in velvety deep black, concolorous, normal in size and form. Claviform variable in size, black lined, concolorous. Secondaries smoky or blackish fuscous, paler toward base. Beneath, powdery, with crimson or carmine scales, and with an outer dark line. Head and thorax concolorous with primaries.

Expands 33–38<sup>mm</sup> (1.32 to 1.52 inches).

HABITAT.—Canada, Maine, Northern New York, Northern and Eastern States.

Four specimens are in the Museum collection: Kittery Point, Maine, July 17 and 18 (C. V. R., J. B. S.); Orono, Maine; Adirondack Mountains, New York (J. B. S.).

A very easily recognizable species, similar to nothing else in the genus. The variety *pulverulenta* at first seems quite different, being dark, powdery gray, with moderately distinct markings. The white patch is distinct, but seems less prominent because there is less contrast. Beneath, there is a lack of the crimson scales. The identity of this form with *assimilis* was not suspected until an examination of the

genitalia had been made. These, however, are so peculiar that their identity was immediately accepted, and the form described as a variety. The tuftings are distinct, but not as prominent as in *lubens*.

The harpes of male are broad and corneous, somewhat enlarged at tip, where they are produced superiorly into a short, curved beak, inferiorly into a broad thumb-like process which is inwardly spinulose, and at middle into a broad, obtuse tooth. No separate clasper.

*Mamestra latex* Gn.

1852. Gn., Sp. Gen. Noct., II, 78; *Aplecta*.

1857. Wlk., C. B. Mus., Lep. Het., XI, 556; *Eurois*.

1873. Grt., Buff. Bull., I, 103; *Mamestra*.

*demissa* Wlk.

1857. Wlk., C. B. Mus., Lep. Het., XI, 723; *Apamea*.

1868. Grt. and Rob., Trans. Am. Ent. Soc., II, 78, pr. syn.

1832. Grt., Ill. Essay, 44, pr. syn.

Grayish white with a faint luteous tinge. A fusco-luteous patch filling superior part of basal space; another, from outer margin of orbicular, embracing the reniform and extending to s. t. line. Terminal space of the same, dusky, shade except at apex. Transverse lines faint, geminate. T. a. line upright, hardly sinuate. T. p. line very faint, crenulate, about parallel with outer margin. Basal half line marked. S. t. line very irregular, marked by the difference in shade between s. t. and terminal spaces. Short black dashes cross the terminal space in whole or in part, opposite cell and in submedian interspace. A row of black terminal lunules. Olaviform small, concolorous, outlined by blackish scales. Orbicular large, concolorous, oval, oblique, outlined by dark scales. Reniform large, kidney-shaped, outlined in black, annulate with pale, suffused by the dusky shade and centrally marked with a brick-red spot. Secondaries powdery, luteous gray. Beneath, pale, powdery, outwardly with a reddish shade, with a common sinuous outer line and lunate discal spot. Head and thorax concolorous with primaries, collar with a black line. Thoracic divided crest distinct. Abdominal tufts small, indefinite.

Expands 39-42 mm (1.56 to 1.68 inches).

HABITAT.—Canada; Northern, Eastern, and Middle States.

Six specimens are in the Museum collection: New Hampshire (J. B. S.); New York (Burnett); Bath, New York, May 15 (Meske); Philadelphia (C. V. R.).

This is a very distinctly marked and easily recognized species. The pale color, dusky shading over reniform, the large size and red shade of that spot, and the very irregular dark terminal space, are characteristic. If, in addition, the male genitalia are examined, no mistake is possible. The harpes are very narrow, slender, enlarged suddenly into a lappet-like tip, which is fringed by a row of spinules. From the broad corneous base which gives rise to the harpe arises also a long, curved, corneous hook, which equals in length or slightly exceeds the

harpe. Below this arises a membranous process, rather obtusely terminated, and about half the length of the harpe. Nearer to base is a stout, twisted, hook-like process, and still nearer is a slender, short, acute, curved hook. This is the most remarkable aggregation of hooks and claws found in the genus.

A close examination of the ♀ abdomen, and of the short, retracted ovipositor, fails to show any peculiarities calling for so complicated an arrangement of grasping organs.

***Mamestra passa* Morr.**

1874. Morr., Proc. Bost. Soc. Nat. Hist., VII, 139; *Mamestra*.

1875. Grt., Can. Ent., VII, 102, ♀ = *penisilis*.

Pale fusco-luteous, with a reddish flush. Transverse lines indistinct. A longitudinal basal black streak. Basal line visible. T. a. line geminate, rather markedly curved between veins, as a whole, outwardly convex. T. p. line superiorly almost obsolete, below reniform distinct, and strongly incurved. S. t. line white, very even, marked by a preceding dusky shade, most distinct near hind margin. Claviform large, concolorous, black margined. Ordinary spots large, pale, incompletely outlined. Orbicular broadly oval, slightly oblique, open superiorly on costa. Reniform kidney-shaped, inferiorly absorbed in the ground color. Beyond reniform the median space is flushed with luteous reddish. S. t. space strongly powdered with white scales, most marked opposite cell and at sinus of t. p. line. Secondaries fuscous. Beneath, sordid fuscous, powdery, with dusky outer line and lunate discal spot. Head and thorax concolorous with primaries. Collar with a black line.

Expands 34<sup>mm</sup> (1.36 inches).

HABITAT.—California.

The ♀ type from Mr. Tepper's collection is the only specimen known to me. The species resembles a small *latex* somewhat, but has a very even, pale, s. t. line, which serves at a glance to separate it. With *penisilis* it has nothing in common.

Group **ADJUNCTA**

Four species are referred here, agreeing in the white blotchy maculation of primaries, the white median lines and obvious though not prominent W-mark in the primaries—never distinct enough to cause a question as to the group to which it should be referred. The wings are trigonate.

*Adjuncta* differs at once by its black ground color and comparatively large size. The sexual characters also differ from those of the others with which it is here associated.

The other species all have moderately broad, trigonate primaries, with acute apices and obliquely rounded margin, the fringes unusually long. The male antennæ have the joints marked, though not serrate, laterally ciliated and furnished with a longer bristle. The genitalia are peculiar

and essentially alike in the species. The harpes are suddenly narrowed and rectangularly bent, the tip variously dilated and fringed. The hind margin is always thickened and corneous, the claspers various, and separately described for each species.

*Variolata* is blotchy. The ground color is yellowish fuscous, somewhat olivaceous. The maculation white and contrasting. A yellow shade runs across the wing through median space, and the apex is conspicuously white.

*Glaciata* is much more even, grayish olivaceous in color, the lines and ordinary spots white marked but scarcely blotchy, as in the preceding. There is a distinct white spot beyond the claviform.

*Minorata* is smaller, of the same ground color and with essentially the same markings as *glaciata*. It lacks the white spot beyond the claviform, and in its place has a dark shade crossing the median space.

In tabular form the differences show as follows:

Large, black; orbicular small.....	ADJUNCTA.
Moderate sized, color variable; orbicular large.	
Maculation blotchy, ground color yellowish fuscous, an apical white patch .....	VARIOLATA.
Maculation not blotchy; no apical white patch.	
A white spot beyond claviform; t. a. line sinuate and dentate.....	GLACIATA.
No such white spot: t. a. line very even, upright.....	MINORATA.

#### *Mamestra adjuncta* Bdv.

1841. Bdv., in Gn. Noct. Ind. Meth., 243; *Miselia*.

1852. Gn., Sp. Gen. Noct., i, 199; *Mamestra*.

1856. Wlk., C. B. Mus. Lep., Het., ix., 234; *Mamestra*.

1873. Grt., Buff. Bull., i, 108; *Hadena*.

1874. Grt., Buff. Bull., ii, 309; *Mamestra*.

1874. Lintn., Ent. Cont., iii, 161; *Hadena* larva on *Solidago*.

1877. Good., Can. Ent., ix, 60; larva on *Pteris aquilina*.

1884. Bean., Can. Ent., xvi, 68; larva on *Wigelia rosea*.

Blackish, maculation white, contrasting. Basal line double, distinct, white. T. a. line irregularly oblique, geminate, white marked on costa. T. p. line crenulate, nearly parallel with outer margin, white marked over costal space. S. t. line broad, white, very irregularly dentate, with a well marked W on veins 3 and 4. A row of terminal black lunules, inwardly margined with white. A few white venular dots through s. t. space. Reniform large, white, with dark central line. Orbicular round, rather small, with white annulus and concolorous center. Claviform black margined, concolorous. Secondaries blackish fuscous, paler toward base. Beneath, primaries blackish, with white powderings. A dusky extra discal line and a submarginal pale line. Secondaries pale, powdered with dusky, with a dusky lunule, extra-discal line, and submarginal shade. Head and thorax blackish, tuftings and patagiæ white marked. Abdomen with rather prominent dorsal tufts.

Expands 35 to 40<sup>mm</sup> (1.40 to 1.60 inches).

HABITAT.—Canada, Northern, Eastern, and Middle States, west to Illinois, Missouri, Minnesota.

Six specimens are in the study series, others in the duplicate material. Localities: Maine, Indiana (J. B. S.); New York (Acc. 14077); Schenectady, New York, August 9 (C. V. R.); Albany, New York, ex larva, May 14 (larva on *Solidago*); Sharon, New York, August 16 (Meske); Philadelphia (C. V. R.).

A very pretty and strongly marked species, not easily mistaken for any other. The black color and contrasting white maculation are unique.

The harpes of male are chitinous at base, with a broad, irregular, inferior projection, beyond which they become suddenly narrower before the dilated tip, which has the inferior edge acute and is inwardly spinulated. The true clasper is chitinous, rather short, and moderately curved.

***Mamestra variolata* Smith.**

1887. Proc. U. S. Nat. Mus., x, 467; *Mamestra*.

Luteous, somewhat olivaceous, prominently maculate with white. Basal space superiorly white half way to t. a. line, crossed by the dark, geminate basal line, thence black to t. a. line. Inferiorly it is of ground color, with a white patch on internal margin at t. a. line. T. a. line geminate, upright, irregularly lunate. T. p. line black, lunulated or crenulated, obsolete geminate, marked with white on costa and near hind margin, its course about parallel with outer margin. S. t. line white, irregular, interrupted, with a feeble W mark, preceded by a series of irregular black spots. A row of black terminal lunules. Claviform faintly and incompletely outlined, concolorous. Orbicular large, white, irregular. Immediately below it is a large, irregular white blotch. Reniform narrow, lunate, rather irregular, white, centered with yellow scales, black ringed. Through the median space there is a broad yellow shade, starting between the ordinary spots bordering the white patch below orbicular, and below that point marked on inner side by two black lunate spots and outwardly by t. p. line. S. t. space irregularly black marked, near hind margin filled by a white blotch. A large apical white patch. Fringes cut with white. Secondaries fuscous. Beneath, fuscous, powdery, with broad outer line and large discal spot. Head and thorax concolorous with primaries, collar with a black line. Patagiae and dorsum with white blotches.

Expands 30<sup>mm</sup> (1.20 inches).

HABITAT.—Washington.

One of the type specimens is in the Museum collection (Coll. J. B. S.), the other is with Mr. E. L. Graef. The species is hardly to be confounded with any other. The blotchy white maculation, yellow median shade, and the peculiar genitalia form a combination of characters not found in any other form known to me.

The harpes of the male have the general shape already described. The lappet like tip is small, inwardly fringed. The clasper is very

stout and heavy, blunt, not curved, extending to the angulation of the harpe.

The species seems rare.

**Mamestra glaciata Grt.**

1882. Grt., Can. Ent., XIV, 170; *Mamestra*.

Fuscous or smoky brown, with an olivaceous tinge, more or less powdered with white scales. Transverse lines distinct, geminate. Basal line distinct, geminate, outer part entirely crossing the wing, outwardly marked by a white shade, most distinct toward hind margin. T. a. line upright, white marked, outwardly oblique, lunulate, and with an outward tooth on internal vein. T. p. line crenulate, irregular, incurved below reniform, an outward tooth on vein 1, white marked, most evidently so toward hind margin. S. t. line white, irregular, forming an indefinite W, black marked. A row of black terminal spots. Terminal space with considerable whitish. Clariform outlined, followed by a white spot. Ordinary spots large, white ringed, centered with a pale shade of ground color. A distinct rivulous median shade line. Secondaries blackish fuscous. Beneath, paler fuscous, powdery. Secondaries with a broad outer line and large discal spot. Head and thorax white mottled.

Expands 30<sup>mm</sup> (1.20 inches).

HABITAT.—Arizona; Colorado.

The male type is very distinct from any other species. A female from Colorado I refer here, though it differs in details of maculation and has less white. In view of the great range of variability in this character I have decided to keep them together until further material authorizes another disposition.

The ♂ harpes are not as broad as in *variolata*, the angulated tip being more prominently spinulated. Along the inferior margin is a thick corneous rim, inwardly toothed near base. A short, broad, concave, corneous clasper near base.

**Mamestra minorata Smith.**

1887. Smith, Proc. U. S. Nat. Mus., x, 467.

Dark fuscous gray or brown, transverse lines distinct, geminate. Basal line distinct, also geminate. T. a. line upright, rigidly even to internal vein, where it is slightly curved and marked with white. T. p. line unusually near to outer margin, lunulate, rather evenly outcurved over reniform, and then oblique to hind margin. At costa and toward hind margin marked with white. S. t. line white, distinct, irregular, with a tolerably well marked W. Apex white, powdery. S. t. space white marked toward hind margin. Claviform obsolete, but its place indicated by a blackish shade extending across the median space. Orbicular large, round, white, with a small dusky center. Reniform large, normal in shape, white marked. At its outer inferior margin is



a large dark patch extending to t. p. line. Secondaries dull smoky fuscous. Beneath, fuscous, powdery, distinct outer line and large discal spot. Head and thorax concolorous with primaries, also white marked. Harpes of male with the angulated tip dilated and rounded, inwardly spinulose. Hind margin corneous, thickened, somewhat incurved. A short beak-like clasper near base.

Expands 30<sup>mm</sup> (1.20 inches).

HABITAT.—California (♂); Colorado (♀).

Not in the Museum collection. I have seen only two specimens, agreeing in essentials; the ♂ from Mr. Edwards, the ♀ from Mr. Bruce. The species looks like *capsularis*, but is not so clearly marked, has not the prominent W mark, and the male genitalia are entirely different.

#### Group DEFESSA.

Robust species with trigonate, somewhat pointed primaries, oblique outer margin, and gray or luteous colors. The group contains species distinguished by no strong characters and is rather negatively defined. The wing form is the only positive feature, and that varies to some extent. Four species are referred to it, two of them luteous, two of them ash gray, and, so far as known, no agreement in the sexual characters.

They may be separated as follows:

Size larger; color luteous.

Sordid luteous; reniform all stained; s. t. line concolorous, not prominent; wings more pointed ..... DEFESSA.

Bright, paler luteous; reniform large, inferiorly dusky; s. t. line distinct, pale, wings less pointed ..... CHARTARIA.

Size smaller, colors ash gray; reniform moderate, not darker.

Pale, median space darker, fuscous ..... REPENTINA.

Dark ash gray, median space concolorous ..... BRACHIOLUM.

*Defessa* is a dark, dull species, like a dirty *trifolii*; the lines are black marked; s. t. line not distinct. The secondaries are dull, smoky brown or blackish.

*Chartaria* resembles a bright form of *trifolii*, but differs in the course of s. t. line. It is the most robust of the species referred here, and the wings are somewhat more rounded.

*Repentina* is a pale form, with much darker median space. The orbicular is small, the reniform undefined.

*Brachiolium* resembles *cuneata*, but lacks the yellow marking, and has much more pointed primaries.

Altogether the group is entirely an artificial one, composed of species without other close allies.

#### *Mamestra defessa* Grt.

1830. Grt., Can. Ent., XII, 88; *Mamestra*.

“Also allied to *trifolii*, but with the subterminal line irregular and dusky; reniform concolorous, with an inferior black stain. The fore

wings are pale ochery clay color, the lines double, faint; stigmata concolorous, with dark defining lines. Thorax concolorous with primaries; no lines on collar. Hind wings whitish at base, with discal lunule and broad exterior fuscous band. Beneath there is a discal cloud and common extra mesial dotted line, which is joined to the discal spot on primaries by dusky scales along the median nervules. Size of *trifolii*. Two specimens. Santa Clara, California, May 22, collected by Baron Osten-Sacken."

The above is Mr. Grote's characterization. I have seen two specimens, also from California, which agreed well with what there is of the description, except that my specimens seemed darker than described. Both of the specimens are females, and the males may agree better with the description. I have no doubt whatever of the correctness of my identification of this species, which is easily known, first, from its resemblance to *trifolii*, and second, by the character of the s. t. line, which is dark and has no W-mark. It seems a rare form.

*Mamestra chartaria* Grt.

1873. Grt., Buff. Bull., 1, 138, Pl. 4, f. 12; *Mamestra*.

Pale to dark luteous gray, powdered with white, median lines geminate, distinct. Basal line present, also geminate. T. a. line outwardly oblique, inwardly angulate on vein 1. A white dot, with black shading on vein 1, just within the tooth of t. a. line. T. p. line lunulate or crenulate, nearly parallel with outer margin. S. t. line pale, irregularly sinuate. A row of black terminal lunules. Ordinary spots large. Orbicular round, pale, with concolorous center. Reniform incompletely dark ringed, inferiorly dusky, slightly constricted at middle. Claviform large, concolorous. Secondaries in ♂ whitish, in ♀ fuscous. Beneath, powdery, with dusky outer line and discal spot. Head and thorax concolorous, collar with a black line.

Expands 32 to 37<sup>mm.</sup>, (1.28 to 1.48 inches.)

HABITAT.—California, Washington.

Three specimens are in the Museum collection: California (J. B. S.); Alameda County, June (through C. V. R.).

The species bears a most deceptive resemblance to *trifolii* in color and maculation, and indeed in general habitus; but it can be always distinguished by the course of the s. t. line, which has not the prominent W-mark, and by the very peculiar harpes of the male, which have not the slightest resemblance to those of *trifolii*. The harpes are irregular, broad, corneous, sending out a finger from upper margin, then narrowing to the tip, which is squarely truncate and furnished with single, long hair. No separate clasper.

The species is not common in collections.

*Mamestra repentina* Morr.1875. Morr., Proc. Bost. Soc. Nat. Hist., XVIII, 118; *Mamestra*.

Grayish, pale; median space fuscous, median lines distinct, geminate. Basal line distinct, geminate, included space fuscous; t. a. line upright, lunulate; t. p. line strongly incurved below reniform, lunulate; s. t. line yellow fuscous, preceded by a slight dark shade, evenly rivulous. A terminal row of small black lunules; fringes rather long, white tipped; s. t. space marked on costa with a fuscous shade, a faint fuscous shade following t. p. line, grading off into the pale ground color. A strongly dentate dark line crosses the median space between the ordinary spots. Claviform obsolete; orbicular large, pale, round; reniform pale with fuscous shade, somewhat constricted at middle, not defined; secondaries fuscous, paler basally. Beneath, fuscous powdery, primaries with outer margin paler, secondaries with outer margin dusky. Head and thorax concolorous with primaries, collar with a blackish line, patagiæ with blackish submarginal lines.

Expands 33<sup>mm</sup> (1.20 inches).

HABITAT.—West Hoboken, New Jersey.

The ♀ type from Mr. Meyer's collection is the only specimen examined. The insect is very different from all its congeners and should be easily recognized. It is passing strange that in a locality so well collected over, specimens should not have been found since, and it gives rise to a suspicion that it is not really an American insect. One collector at least, in the good old time, distributed exotics as taken at Hoboken; witness *Sphinx ligustri* and *convoluti* in my own collection, declared upon the most solemn assurances taken at West Hoboken!

*Mamestra brachiolum* Harv.1876. Harv., Can. Ent., VIII, 6; *Mamestra*.

Dark ash gray, powdery, median space darker, median lines present, not strongly marked, geminate; basal line visible; t. a. line outwardly oblique, not much curved between veins; t. p. line slightly lunulate or crenate, parallel with outer margin; s. t. line pale, sinuate, interrupted; a narrow black terminal line; an obsolete, irregular black line crosses median space between ordinary spots; claviform faintly indicated or wanting; ordinary spots moderate, pale; orbicular round; reniform kidney-shaped; secondaries smoky fuscous, paler at base; beneath, powdery gray, with common outer line and discal spot; head and thorax concolorous with primaries, collar with a dark line.

Expands 27<sup>mm</sup> (1.08 inches).

HABITAT.—Texas, Arizona.

Bears a resemblance to *cuneata* in maculation, and compared with that species by Dr. Harvey. It is, however, less distinctly marked than that species, though much after the same style. In wing form this species differs also in having the primaries somewhat narrower and

more pointed. It lacks all yellow shading, so prominent in the Californian species.

The genitalia are distinctive and simple. Harpes narrowing toward tip, where they are curved and subacute, not spinulated. The clasper is moderately long, slender, curved, with acute tip.

The species seems not common and is not represented in the Museum collection.

#### Group LEGITIMA.

The species referred here, agree in rather plump build, usually distinctly though not prominently tufted thorax, and in large, broad wings in which the apices and outer margin are rounded.

Two rather well marked divisions are indicated, the first embracing those species in which the primaries have a predominating reddish or violet gray shade, and the second, those in which the color is a sordid fuscous brown.

*Beantii* is the largest species in the group, and heads the first division. It is evenly colored, all the normal markings present, not contrasting. The claviform is very small.

*Legitima* agrees in having the claviform very small, but is brightly and not evenly colored, and is smaller sized.

*Lilacina* is more gray than the preceding, and the claviform is large. The s. t. line is sinuate.

*Rugosa* is smaller, but very similar in color and maculation. The s. t. line, however, is very even and preceded by cuneiform blackish marks. The reniform is narrow.

All the species agree in the general style and form of the ♂ genitalia (*beantii* of which only the ♀ has been examined, perhaps excepted) and none of the species in the next series agree with them in this respect.

Of the series with fuscous or dull blackish brown primaries, *noverca* is easily distinguished by its rather narrower wings, which are also somewhat paler than any of the others, and the conspicuous black basal mark, which is wanting in all the other species.

*Goodelli* is very even in color, and has no contrasting maculation save that the reniform is usually paler than the rest of the wing. There are no black shades or marks preceding the s. t. line as are in all of the rest of the series. The species is eastern.

*Quadrata* is rather easily distinguished by the small W in the s. t. line, by the paler patch in the s. t. space opposite anal angle, and by the quadrate black spot following claviform to t. p. line. The latter, however, is a variable quantity and not always distinct. The species is Californian.

*Obscura* resembles the preceding, but has none of its specific characteristics. The s. t. line is even, but not prominent; there is no observable claviform, and the s. t. space is evenly colored. It has no obvious peculiarities of its own.

*Ectypa* is a very pretty species, as its synonym, *bella*, suggests. The maculation is much of the same type as the preceding, but prettily contrasting; the s. t. line unusually prominent, pale; the claviform large and black filled. The only specimens thus far known are: One in the Museum collection (C. V. R.), taken by Mr. Andrews in New Jersey; the type of the species in Mr. Meyer's collection from West Virginia, and the type of *bella* in Mr. Neumoegen's collection, also taken in New Jersey.

In tabular form the species divide as follows:

Primaries with a violet gray or reddish flush.

Claviform very small.

Color very even, size large..... BEANII

Color not even, maculation contrasting, size smaller..... LEGITIMA.

Claviform rather large.

Larger, s. t. line sinuate, not preceded by black, sagittate marks..... LILACINA

Smaller, s. t. line very even, preceded by black, sagittate marks..... RUGOSA

Primaries sordid luteous gray to blackish brown.

Rather narrower winged; a distinct, curved, basal black mark to t. a. line..... NOVERCA.

Broader winged; no basal dash or black mark.

S. t. line not preceded by black spots or shades, color very even..... GOODELLI

A somewhat contrasting, pale, s. t. shade in submedian interspace;

a small W in s. t. line..... QUADRATA.

S. t. space even; no W in s. t. line. Color even, dull; maculation obscure; claviform concolorous or wanting..... OBSCURA.

Brightly marked; s. t. line unusually distinct, pale; claviform black; contrasting..... ECTYPA

#### *Mamestra beanii* Grt.

1877. Grt., Can. Ent., ix, 87; *Mamestra*.

1879. Grt., No. Am. Ent., i, 12; *Mamestra*.

Dark fuscous, with a reddish violet suffusion, something as in *legitima*. Median lines distinct, though not prominent, geminate. Basal line present. T. a. line with an even outward curve, slightly dentated on the veins, outer line most distinct, included space paler, with a bluish tint. T. p. line very regularly sinuate and lunulate, inner part of line most evident. An incomplete row of pale venular dots through s. t. space. S. t. line narrow, pale, powdery, preceded by a rust-brown shade. A row of black lunate terminal dots. Apex powdered with gray scales. Claviform minute, concolorous, black margined. Orbicular small, oblique, oblong, pale powdered. Reniform rather narrow, upright, superiorly reddish, inferiorly dusky. Secondaries yellowish fuscous. Beneath, powdery, with small discal spots. Head and thorax concolorous with primaries.

Expands 40 mm (1.60 inches).

HABITAT.—Illinois, Texas, ? Colorado.

I have had two females only, the one fully agreeing with the type, from Texas; the other, somewhat aberrant in maculation, from Colorado. This latter may eventually prove distinct when males are available, but at present I do not care to separate them.

*Mamestra legitima* Grt.1864. Grt., Proc. Ent. Soc. Phila. III, 82, Pl. 2 f. 4; *Apamea*.1874. Grt., Proc. Bost. Soc. Nat. Hist., XVI, 241; *Mamestra*.

Blue gray, more or less suffused with bright red-brown. Median lines distinct, though not prominent, obsoletely geminate. Basal line evident. T. a. line with an even outward curve, slightly dentate on the veins. T. p. line about even with outer margin. S. t. line narrow, pale, slightly dentate on veins 3 and 4, marked by the dusky terminal shade and a distinct red-brown preceding shade. Claviform very small, black margined. Orbicular large, gray, not distinctly defined. Reniform large, completely defined, with a narrow, pale annulus, brown red in color, inferiorly dusky. The red shade occupies a variable part of the wing; usually nearly the entire basal space, the median space above claviform, and the costal portion of the s. t. space is of that color. A row of geminate, black venular dots through s. t. space. Secondaries luteo-fuscos, outwardly darker. Beneath, powdered with violet red toward margins. A small discal spot. Head and thorax concolorous with primaries, collar with a black line.

Expands 33-38<sup>mm</sup> (1.32 to 1.52 inches).

HABITAT.—Canada; Eastern, Middle, and Central States.

Nine specimens are in the Museum collection: New Jersey; Lewis County, New York, June 30, July 4 (Meske); Washington, District of Columbia, August 22, September 9 (C. V. R.).

This is a very pretty species, readily recognizable by its gray and red colors, and small claviform. The antennæ of the male are laterally bristled. The harpes are angulated toward tip, the angle superiorly prominent; tip enlarged and superiorly acutely drawn out, inwardly spinulose. Just behind the angulation of the harpe arises the small, beak-like clasper.

*Mamestra lilacina* Harv.1874. Harv. Buff. Bull., II, 119; *Mamestra*.*illabefacta* Morr.1874. Morr., Proc. Bost. Soc. Nat. Hist., XVII, 141; *Mamestra*.

1874. Grt., Buff. Bull., II, 211; pr. syn.

1875. Grt., Can. Ent., VII, 58; pr. syn.

1879. Grt. Can. Ent., XI, 128; pr. var.

Bluish gray, with a dark, somewhat reddish fuscos shade through superior half of wing, interrupted only at apex. Terminal space also dusky. Median lines evident, geminate. Basal line present. T. a. line outwardly oblique, lunate. T. p. line crenulate, parallel with outer margin. S. t. line concolorous, broad, marked by the dark terminal space and a preceding narrow, dusky shade. A row of brown terminal lunules. A narrow transverse shade through median space, rather darkening the cell between the ordinary spots. Claviform moderate in size, darker. Orbicular large, oblique, gray. Reniform rather large, somewhat constricted at middle, black margined, inferiorly dusky.

Secondaries fusco-luteous, darker outwardly. Beneath, powdery, with darker outer line and discal spot. Head and thorax concolorous with primaries, collar with a dark line.

Expands 32–35<sup>mm</sup> (1.28 to 1.40 inches).

HABITAT.—Canada; Northern, Eastern, Middle, and Central States.

Eight specimens are in the Museum collection: Maine (J. B. S., C. V. R.); Lewis County, New York, July 4 (Meske).

A modestly marked species, rather variable in the amount of dark shading to the primaries. The type of Mr. Morrison's *illabefacta* is a pale specimen, but not entitled to rank as a variety. The rather contrastingly dark terminal space and even s. t. line will serve to identify this species.

The harpes of male are bent toward tip, the angle somewhat produced and corneous, at tip enlarged into a concave lappet, which is somewhat acutely produced at its upper edge. Inwardly it is fringed and densely matted with spinules. At the angle there is a small beak-like process. The clasper is single, rather short, and moderately stout.

*Mamestra rugosa* Morr.

1875. Morr., Proc. Bost. Soc. Nat. Hist., XVIII, 119; *Mamestra*.

Bluish or violet gray. Median space, terminal space, superior portion of basal space, and a costal patch in s. t. space red-brown. Basal line hardly traceable. A short, black longitudinal dash. T. a. line outwardly oblique, somewhat curved, and slightly dentate on the veins, obsoletely geminate. T. p. line parallel with outer margin, even. S. t. line very even, yellowish, marked by the dark terminal space and a preceding row of black spots. Apex pale. Claviform small, narrow, concolorous. Orbicular pale, narrow-ovate, oblique. Reniform constricted at middle, slightly oblique, with yellow annulus, else concolorous. Secondaries yellowish at base, outwardly fuscous. A dark discal lunule. Beneath yellowish, with darker discal dots and outer margin. Head and thorax concolorous with primaries, collar with a dusky line.

Expands 32<sup>mm</sup> (1.28 inches).

HABITAT.—Maine.

A single specimen, without locality, is in the Museum collection (C. V. R.).

The species is easily recognized by the yellowish secondaries and the very rigid, broad s. t. line.

The harpes are bent near tip, where they are enlarged, as in *legitima*, and furnished at tip with a long, stout spine. Tip with only a fringe of spinules. Clasper very simple, consisting of a slightly curved and rather slender, corneous hook.

*Mamestra noverca* Grt.

1878. Grt., Can. Ent., x, 230; *Mamestra*.

Fuscous brown, with blackish irrorations. Median lines distinct, geminate, included spaces pale; basal line distinct; a black basal dash,

attaining the t. a. line; t. a. line sinuate, outwardly oblique; t. p. line very even, parallel to outer margin; s. t. line narrow, interrupted, irregularly sinuate, marked by a row of preceding sagittate black dashes. A row of black terminal lunules. A pale line at base of fringes. Claviform wanting. Orbicular small, oval, concolorous or a little paler, black ringed, sometimes connected with the t. a. line. Reniform upright, rather narrow, pale, with sometimes a dark center. Secondaries pale luteo-fuscous, outwardly darker. Beneath, somewhat reddish, powdery, with outer line and small discal spot.

Expands 31–33<sup>mm</sup> (1.24 to 1.32 inches).

HABITAT.—California, Colorado, Arizona, Nebraska.

Two specimens are in the Museum collection: Arizona, Colorado (J. B. S.).

This is a well distinguished form, recognizable by the even, pale t. p. line, and the narrow, upright, pale reniform.

Harpes of male gradually broadening toward tip, where they are superiorly longer, the ends squarely cut off. Clasper rather long, and at base slender, twisted, at tip beak-like.

*Mamestra goodelli* Grt.

1875. Grt., Can. Ent., VII, 223; *Mamestra*.

Dull sordid fuscous brown, with the lines obliterated or but feebly marked. Sometimes there are local brownish or green shades, not definitely marked, and so variable that they are not describable. The basal line is usually present; t. a. obsoletely geminate, outwardly convex, indented on the veins; t. p. line crenulate, parallel with outer margin; s. t. line indefinite, pale, irregular, preceded by a dusky shade. Claviform black filled, but usually indefinitely limited and somewhat variable in size. Ordinary spots concolorous or somewhat paler, black ringed, moderate or small in size, and somewhat variable in shape. Cell usually a little darker between these marks. Secondaries paler, smoky fuscous. Beneath, variable in shade, with a common outer line and discal spot, which are also variably distinct.

Expands 28–34<sup>mm</sup> (1.12 to 1.36 inches).

HABITAT.—Canada; Northern, Eastern, and Middle States, west to Nebraska.

Five specimens are in the Museum collection: Holderness, New Hampshire, July 16 (C. V. R.); New Hampshire, July 20 (U. S. N. M.); Sharon, New York, August 4 (Meske); Lewis County, New York, July 10 (U. V. R.); New York (J. B. S.).

An obscure species, decidedly variable in size and maculation. It varies in the distinctness of the median lines, the shade of the ground color, the prominence of the claviform, which is sometimes barely traceable, though usually black and contrasting, and also in the amount of black around the ordinary spots. The form from Nebraska is more sordid and evenly marked than the eastern specimens, but seems other-



wise the same. The vestiture is somewhat loosely applied, hence perfect specimens are rare.

The male harpes are strong, gradually tapering to an obtusely rounded tip. The clasper is short, thick, curved, jaggedly truncate at tip. Just below the base of this clasper is a broad pad, densely clothed with small teeth or spinules.

*Mamestra quadrata*, sp. nov.

Dull fuscous brown, collar with a distinct black transverse line narrowly margined with reddish scales. Primaries varying somewhat in shade, obscurely marked, yet all the maculation traceable. Basal line geminate, defining lines blackish brown, included space somewhat paler, especially in the submedian interspace, where it is reddish; t. a. line upright, with three rather even outcurves between the veins, geminate, the defining lines blackish brown, incomplete, interrupted, included space lightened by a few reddish scales; t. p. line rather evenly bisinuate, not greatly outcurved over reniform, geminate, the inner line only distinct, the outer rarely traceable in the somewhat paler s. t. space; s. t. line rather evident, narrow, pale, forming a small W-mark on veins 3 and 4, additionally marked by a variably evident series of preceding sagittate dashes, which are sometimes entirely wanting, and by the darker terminal space. A narrow, dark, terminal line. Fringes with a pale line at base, cut with yellowish opposite the veins. These latter are more or less obviously marked with white and black scales, rendering their course traceable. The s. t. space is paler than the rest of the wing, becoming somewhat contrasting in the submedian interspace, and forming in some specimens the only prominent feature. Claviform concolorous, moderate in size, more or less completely defined by black scales, sometimes barely traceable. Beyond this is sometimes a quadrate black patch extending to the t. p. line, and contrasting strongly with the following pale patch in s. t. space; but this is sometimes reduced to two parallel black lines, and more rarely wanting altogether. The ordinary spots are concolorous or very slightly paler; a little powdery. Orbicular oval, scarcely defined. Reniform slightly constricted, better defined by an annulus of pale scales. Secondaries, even smoky brown, with a faint discal lunule. Beneath, dull brown, powdery, with a darker discal lunule and a dusky outer line, which may be distinct on both wings, wanting on primaries only or entirely absent.

Expands 31 to 33<sup>mm</sup> (1.24 to 1.32 inches).

HABITAT.—June and July, Placer County, California. (Through C. V. R.)

There are eight good specimens in the Museum collection, some of which bear the red number 247, indicating biologic notes in Dr. Riley's possession.

The species is broad winged, and in this and the general vagueness of its maculation it resembles *desperata*. The small indentations of the

s. t. line are not enough marked to refer the species to the *W-album* group.

The genital structure of the male is characteristic. The harpes are upcurved beyond the middle, and then abruptly, nearly rectangularly bent, and produced into a narrow spur, broadening lappet-like at tip, and there inwardly spinulose. From this bend, superiorly, arises the stout somewhat twisted and irregular corneous clasper, not reaching the tip of the harpe. The figure will probably explain this structure more satisfactorily.

*Mamestra obscura* Smith.

1887. Smith, Proc. U. S. Nat. Mus., x, 463; *Mamestra*.

Dull, smoky, fuscous, with a faint brownish tint. Median lines vague or obsolete. S. t. line distinct, narrow, pale, marked by a preceding black shade. A pale line at base of fringes. Claviform wanting. Ordinary spots incompletely black margined, concolorous. Reniform, with a faint reddish flush. Secondaries, pale fuscous. Beneath, even, pale, powdery, with dusky outer line and discal spot. Head and thorax concolorous with primaries, collar pale tipped.

Expands 33<sup>mm</sup> (1.32 inches).

HABITAT.—? Arizona, Wisconsin.

The type is in the Museum collection, presumably from Arizona (coll. J. B. S.), and I have associated with it another specimen from Wisconsin (coll. O. Meske), which differs in the more obvious median lines, but seems similar in all other respects. Both are males, and the sexual characters agree, in main features at least, so far as I could examine them. The locality of the type is uncertain. It came to me with a lot of Arizona material, but from a collection containing much from other localities. The thoracic and abdominal tuftings are distinct, but not prominent. The harpes of male are rather broad, somewhat abruptly tapering to an acute tip. The clasper is moderately long, somewhat irregular, slightly curved and acute at tip.

*Mamestra ectypa* Morr.

1875. Morr. Proc. Bost. Soc. Nat. Hist. XVIII, 118; *Mamestra*.  
*bella* Grt.

1883. Grt., Papilio, III, 30; *Mamestra*.

Rather rich, dark, umber brown, with a violet tinge before t. a. and after t. p. line. Basal line distinct, double. T. a. line rather even, outwardly curved, a strong dent on vein 1. T. p. line lunulated, nearly parallel with outer margin; both lines obsoletely geminate. S. t. line contrasting, pale yellow, sinuate, marked by preceding dark spots. A row of black terminal lunules. Claviform outlined in velvety black, and followed by a pale shade which extends obliquely upward over the orbicular to costa. Orbicular rather large, oval, oblique, pale ringed, with a somewhat darker center. Reniform rather long, upright or slightly oblique, black margined, concolorous or slightly paler. Second-

aries smoky fuscous. Beneath, powdery, secondaries with double outer lines more or less evident, and dark discal spot.

Expands 27–30<sup>mm</sup> (1.08 to 1.20 inches).

HABITAT.—New Jersey, West Virginia.

A single, poor specimen from New Jersey is in the Museum collection (C. V. R.).

I have seen the types of both Morrison's and Grote's species and they are identical in specific characters. The species is readily known by the bright coloration and the prominent yellow s. t. line.

The harpes are semi-chitinous, inferiorly with a thickened chitinous margin. The tip is somewhat narrowed, lappet-like. From the corneous inferior margin arises a short, cylindrical, corneous clasper, and behind this a small beak-like process.

#### Group **RENIGERA.**

The four species that are placed in this group, though very distinct in color and maculation, are yet closely allied in structure. They are all small, rather plump forms, with short, obtuse primaries, fringes rather long and thoracic tuftings distinct. The abdomen is tufted only at base, and that indistinctly, but is furnished in the male with evident lateral tufts. The male antennæ have the joints well defined and ciliated; without being serrated. The male genitalia are after the one type. The harpes are broad at base, suddenly narrowed or deeply emarginate at upper side, leaving an acute, pointed tip, inwardly margined with spinules. The clasper is a long, slender, curved hook.

*Renigera* is darkest, with prominently marked green reniform. There is a green patch at base and another near hind angle. The claviform is black.

*Egens* is usually paler, lacks the green patches, but has the reniform outlined in white. The claviform is not at all prominently marked. The darker forms are Mr. Grote's *cinnabarina*, the paler forms have been named *ferrea*, also by Mr. Grote.

*Spiculosa* is a very pretty species, differing from the preceding by the distinct median lines and neatly outlined ordinary spots. The reniform is not prominently white marked and the veins are pale through median space.

*Circumcincta* is marked like *egens*, but has the gray color and superficial appearance of *olivacea*, connecting the two groups.

A table is scarcely necessary for the definition of these forms.

#### **Mamestra renigera** Steph.

1829. Steph., Ent., Haust., II, 16; *Celæna*.

1857. Wlk., C. B. Mus., Het., x, 262=*herbimacula*.

1863. Riley, 1st Rept. Ins. Mo., 86, f. 31.

1874. Grt., Can. Ent., VI, 132; *Mamestra*.

1881. Riley, Suppl. to Mo. Repts., 56; *Mamestra*.

1883. Edwards, Papilio, III, 133; larva on *Cichorium intybus*.  
*herbimacula* Gn.

1852. Gn., Sp. Gen. Noct., I, 223, *Celæna*.

1857. Wlk., C. B. Mus., Lep. Het., x, 262; *Celæna*.

Dark brown with a variably evident carmine suffusion, often distinct only in the s. t. space, but usually embracing the entire wing. Median lines more or less indistinct, obsoletely geminate. Basal line present. Basal space with a mossy green longitudinal shade, and a black spot at inner margin. T. a. line outwardly oblique, slightly sinuate. T. p. line nearly parallel with outer margin, even. S. t. line irregular, marked by the contrast between the darker terminal and paler s. t. space. Claviform moderate in size, black. Orbicular small, round, black margined, rather paler. Reniform upright, small, narrow, white ringed, mossy green. A black shade surrounds the reniform and is continued through the median space close to the t. p. line. A large patch of mossy green in the s. t. space near hind angle. Secondaries whitish with fuscous powdery outer and costal margins. Beneath, dark fuscous, with carmine powderings. Secondaries paler. Head and thorax concolorous with primaries.

Expands 25–30<sup>mm</sup>. (1 to 1.20 inches).

HABITAT.—Canada, south to Georgia, west to Nebraska.

The Museum series contains twelve specimens, and others are among the duplicates. The localities represented are: Union County, Illinois, May 25; Missouri; North Carolina; Washington, District of Columbia, June 11–29, August 28, September 9 (C. V. R.); New York (J. B. S.); Sharon, New York, July 27 (Meske); Northern Illinois; Buffalo, New York; Lincoln, Nebraska (Museum collection).

Our most common eastern species, and very easily recognized. It is one of the smallest of the eastern species, and does not vary to any great extent. The dark brownish primaries, mossy green markings, and white marked reniform sufficiently define the species.

Some of the Museum specimens bear the Riley number, 2663, and are bred. The larva has been several times described in economic literature.

*Mamestra egea* Wlk.

1857. Wlk., C. B. Mus., Lep. Het., x, 263; *Celæna*.

1882. Grt., Ill. Essay, 45; *Celæna*.

1889. Butler, Trans. Ent. Soc. Lond., 386; *Mamestra*.  
*stricta* Wlk.

1865. Wlk., Suppl. C. B. Mus., Het., III, 728; *Hadena*?

1889. Butl., Trans. Ent. Soc. Lond., 386; pr. syn.  
*ferrea* Grt.

1875. Grt., Can. Ent., VII, 25; *Mamestra*.

1881. Grt., Can. Ent., XIII, 130; *Mamestra*.

1889. Butl., Trans. Ent. Soc. Lond., 386; pr. syn.  
var. *CINNABARINA* Grt.

1874. Grt., Proc. Bost. Soc. Nat. Hist. xvi, 241; *Mamestra*.

Varying from pale rust to dark brown, median and terminal space dark brown. Median lines geminate. Basal line distinct. T. a. line outwardly oblique, curved between veins. T. p. line rather even, outwardly curved over reniform. S. t. line narrow, sinuate, concolorous, usually marked only by the difference in shade between s. t. and terminal space, rarely preceded by a dusky shade; sometimes, in dark

specimens, hardly traceable. Claviform rather small, concolorous. Orbicular small, oblique, slightly paler. Reniform small, upright, with broad white annulus, somewhat constricted at middle. An indefinite dark shade through median space. Secondaries smoky fuscous. Beneath, dusky with reddish powderings. Head and thorax concolorous with primaries, the latter with tuftings distinct. Antennæ and genitalia of male essentially as in *spiculosa*.

Expands 25–27<sup>mm</sup>. (1 to 1.08 inches).

HABITAT.—California, Oregon, Washington, Vancouver, Hudson's Bay territory.

Of the type form, *ferrea* Grt., seven specimens are in the collection: California (C. V. R.); Washington, Vancouver (J. B. S.).

Of the form *cinnabarina* Grt. there are nine specimens: California (Meske, C. V. R.); Marin County (J. B. S.); Placer County, September; Los Angeles County, October (through C. V. R.); Washington (Meske, J. B. S.)—specimens of each form labeled by Mr. Grote.

This is rather a variable species in ground color, though the maculation is constant and easily recognizable. The white ringed reniform is a conspicuous feature, and this species replaces *renigera* on the Pacific coast.

In the synonymy I have followed Butler, who makes his references with the types under examination, and speaks positively.

Mr. Grote says in the Ill. Essay, 45: "The single specimens representing *Celena punctifera*, *infecta*, and *egens* are really so poor that I do not think the species can be made out with satisfactory certainty."

#### *Mamestra spiculosa* Grt.

1883. Grt., Can. Ent., xv, 28; *Mamestra*.

Somewhat luteous brown, all the lines distinct, paler. Median lines geminate. Basal line present. Basal space evenly colored. T. a. line evenly oblique, the defining lines narrow, dark, the included space pale. T. p. line even, outwardly angulate over reniform. Median space somewhat darker than base, the veins yellowish marked. Claviform dusky, rather large in size. Ordinary spots concolorous, pale ringed. Orbicular rather large, oblique. Reniform narrow, upright. Beyond the t. p. line the s. t. space is pale, gradually becoming darker to outer margin. S. t. line pale, distinct, sinuate, curved round the pale apical patch. A row of black terminal lunules. Fringes pale lined at base. Secondaries soiled whitish. Beneath, gray fuscous, powdery, a discal spot on all wings. Head and thorax concolorous with primaries. The male antennæ have the joints well defined, but hardly serrate. The genitalia are those of the group.

Expands 25<sup>mm</sup> (1 inch).

Readily distinguished by the irregular ordinary spots and the pale median lines. Its close connection with the others of this group is marked by the identity of habitus and wing form.

*Mamestra circumcincta*, sp. nov.

Head and thorax dark gray with a brownish admixture. Collar inferiorly more brownish, crossed by a black line, white tipped. Patagiæ black margined. Primaries dark gray, with a variable reddish admixture, obvious always in the s. t. space; median space more blackish. Basal line distinct, geminate, black margined; included space paler, a curved black mark emphasizing its lower external boundary. T. a. line oblique, outcurved between veins, geminate, black, the included space paler. T. p. line geminate, black, outer line less distinct, included space paler, outcurved over cell and evenly oblique below. S. t. line irregular, faint, narrow, marked by a preceding dusky patch in s. t. space on costa, and the darker terminal space, white marked opposite anal angle. An interrupted black line at base of fringes, which are cut with pale. The claviform is small, but distinct and black ringed. Orbicular colorous or a little paler, irregularly ovate, oblique, incompletely black ringed. Reniform upright, small, centrally constricted, white ringed as in its allies. Secondaries whitish gray, sometimes with a brownish admixture, with a vague dusky discal lunule and a dusky terminal line. A yellowish line at base of fringes. Beneath, whitish, powdered with black, a vague outer line and discal spot on secondaries.

Expands 25-29<sup>mm</sup> (1 to 1.16 inches).

HABITAT.—Sierra Nevada, California.

Both sexes are from Mr. Edwards's collection. There is a difference in the amount of reddish admixture in the two specimens before me, the female inclining to the *cinnabarina* type, while obviously different by the squamose vestiture and complete black lines, and the male resembling *olivacea* so strongly that I compared it closely at first, expecting a variety of this protean form. The sexual characters, however, refer the species to the *renigera* group.

## Group OLIVACEA.

The species of this group agree in small size, rather robust form, in short stumpy primaries and distinctly tufted thorax and abdomen, the latter in the ♂ also with lateral tufts. In appearance, *i. e.*, wing form and habitus, the species are related to the *renigera* group, from which they differ in the form of the male genitalia. This is alike in all the species referred here. The harpes are broad at base, rather abruptly narrowing and then again gradually widening into a rounded, concave lappet which is inwardly spinulose at tip. The clasper is moderately curved and corneous, half the length of the harpes.

Three species are referred here, separated as follows:

T. p. line sinuate, incurved below reniform. ....	OLIVACEA.
T. p. line rigidly oblique from subcostal. ....	RECTILINEA.
Median lines unusually approximate, curved toward center of wing, and almost touching at inner margin. ....	VAU-MEDIA.

Color can not be used in this group, for there is a most distressing amount of variability in this respect. *Olivacea* especially has an exceedingly wide range of variation, and it requires a long series to adequately show the connection of the extremes.

It would not be a matter of much surprise if eventually all the species here referred proved forms of the same type.

***Mamestra olivacea* Morr.**

1874. Morr., Proc. Bost. Soc. Nat. hist., xvii, 143; *Mamestra*.

1875. Grt., Can. Ent., vii, 27; *Mamestra*.

1877. Grt., Bull. U. S. Geol. Surv., iii, 797; *Mamestra*.

1887. Smith, Proc. U. S. Nat. Mus., x, 465; *Mamestra*.  
*comis* Grt.

1877. Grt., Bull. U. S. Geol. Surv., iii, 85; *Mamestra*.

Var. *OBSCURIOR* Smith.

1887. Smith, Proc. U. S. Nat. Mus., x, 465; *Mamestra*.

Gray to brown fuscous, median space darkest, basal space paler toward t. a. line, subterminal space pale gray, terminal space variable, but always darker than the subterminal. The whole wing is often more or less completely suffused with mossy green and with a more or less evident pinkish shade in basal and s. t. spaces. Basal line geminate, black; included space paler than ground color, sometimes reddish. A short, often not evident, basal dash. Median lines geminate, the included space pale. T. a. line with an even, somewhat oblique outward curve, rarely with a slight tooth on vein 1. T. p. line even, outwardly curved over reniform and inwardly curved beneath. The outer portion of the line is often indistinct, the included space always pale. S. t. line pale, irregularly sinuate, sometimes marked only by the contrast between the terminal and s. t. spaces, but more usually preceded by a dusky shade. Claviform always outlined but usually very indistinct, lost in the dark ground color. Orbicular small, ovate oblique, slightly paler. Reniform upright, oblong, often with a median constriction, whitish, prominent. The s. t. line is often accompanied by a greenish shade, and there is sometimes a reddish shade near hind margin. On costa the median space is of the ground color. Secondaries smoky fuscous to blackish, paler at base. Beneath, dusky, with outer dark line and discal spot. Head and thorax concolorous with primaries, patagiæ often discolored, white.

Expands 23–26<sup>mm</sup> (.92 to 1.04 inches).

**HABITAT.**—Atlantic to Pacific, through northern and middle United States; Canada.

Nine specimens are in the Museum series, others in the duplicates. Localities are: New York (C. V. R., J. B. S.); Sharon, New York, July 28, August 10 (Meske); central Missouri, northern Illinois (C. V. R.); Montana (J. B. S.); Utah (from Department of Agriculture).

This is decidedly the most variable of our species of *Mamestra*. It varies in ground color and in degree of contrast between the pale and dark portions of the wing. Sometimes it is almost evenly gray; often

prettily marked with mossy-green and rose-red, with strongly contrasting white s. t. space; again with a very even yellowish-green suffusion.

The type of *comis* is a very bright, strongly marked specimen, like typical *olivacea*, but so spread that the insect appears more plump, shorter winged, and differently marked.

The variety *obscurior* is from Maine, and is very evenly dark gray with a green suffusion, the lines velvety black, a red shade on t. p. line inferiorly, secondaries blackish.

Variable as is the species in color, it is constant in essential details of maculation. The median lines do not vary to any appreciable extent, and the reniform is always distinctly paler than the ground color. Its range is very wide, but none of the varieties seem to be races.

***Mamestra rectilinea* Smith.**

1887. Smith, Proc. U. S. Nat. Mus., x, 465; *Mamestra*.

Dark fuscous brown, with a deep crimson brown shading which is variably distinct, and a yellowish, somewhat mossy green shading over all. T. a. line geminate, with wide, rather irregular outward curve. T. p. line angulate on costa, then rigidly oblique to hind margin, geminate. Basal line distinct, geminate. S. t. line rarely distinct, pale, its course sinuate. Usually it is more or less lost in the irroration of the outer part of wing. Ordinary spots essentially as in *olivacea*, but the reniform is not so contrasting. Secondaries varying from fuscous to blackish, paler toward base. Beneath, dark gray, powdery, with variably distinct outer line and discal dot. Head and thorax concolorous with primaries, patagiæ sometimes with white disc.

Expands 25–28<sup>mm</sup> (1 to 1.12 inches).

HABITAT.—New York, Colorado, California, Oregon, Vancouver.

Eight specimens are in the Museum collection: New York (through C. V. R.); Vancouver (J. B. S., the types).

Essentially like *olivacea*, from which it differs primarily in the very evenly oblique t. p. line, and more irregular t. a. line. The maculation is more powdery, and there is never so much contrast in the s. t. space. There is usually a prominent, paler patch in s. t. space near the hind angle, which forms an obvious feature in the appearance of the insect. The abdomen of the female exceeds the secondaries, and is rather prominently tufted. It is barely possible that this is a race of *olivacea*, but a series of 26 specimens of the latter species—many of them western—do not show any tendency to invalidate the characters upon which the species is based. On the other hand the identity of the male characters indicates a very recent separation from the parent stock.

***Mamestra vau-media* Smith.**

1887. Smith, Proc. U. S. Nat. Mus., x, 466; *Mamestra*.

Dark smoky gray, paler, with a reddish tinge beyond the t. p. line. Basal line indistinct. T. a. line geminate, unusually remote from base, outwardly oblique, even, very slightly curved. T. p. line obsoletely geminate, slightly curved and inwardly oblique, reaching the hind



margin close to the t. a. line. S. t. line pale, irregular, hardly traceable; a pale spot near internal angle. Ordinary spots concolorous, subequal, almost lost in the dusky ground color. Claviform indicated by a dusky blotch on t. a. line. Secondaries blackish outwardly, with base paler. Beneath, fuscous gray, powdery. Head and thorax concolorous with primaries.

Expands 23<sup>mm</sup> (.92 inch.).

HABITAT.—Colorado. Collected by Bruce.

This little species is easily recognized by the V-shaped median space, beyond which the wing is paler and with a reddish tint inferiorly. The ordinary spots are practically obsolete.

There is a possibility that even this striking form is only an extreme offshoot from the *olivacea* stock, though I have nothing to indicate that it is at all likely, except the identity of the male sexual characters.

#### Group LAUDABILIS.

The species referable to this group agree in small size and, except in *lorea*, pale or gray ground color, with more or less yellow or reddish maculation, some forms being very pretty. They are rather stoutly built, the wings are rather small, obtuse; in *cuneata* and *lorea* rather wider than in the others. The thorax and the abdomen dorsally and laterally are more or less evidently tufted. The chief character drawing together the species is in the male genitalia. The harpes are elongate, very slender, and rather gradually dilated at tip. Inwardly the tip is produced somewhat acutely, and, except in *lorea*, it is more or less truncate. The clasper is short, stout, corneous, hook-like. The species are, some of them, very closely related, and judgment is required in placing single specimens where the genitalia are not examined.

*Lorea* is separable at once by its yellow-red color. In this it is peculiar, and, with its single transverse lines, the t. p. very evenly oblique, it is a readily recognizable form.

*Incurva* and 4-*lineata* are distinguished by white secondaries in both sexes. They are separable by the course of the t. p. line, which, in *incurva*, is drawn in beneath the reniform, and rather even, while in 4-*lineata* it is lunulate and oblique. The latter is a decidedly variable species, and in some of its forms is very like *laudabilis* or *marinitincta*; but it is always recognizable by its white secondaries.

The sexual characters are those of the group, the tip of the harpes truncate, very little produced inwardly. The clasper is very stout, somewhat beak-like.

The remainder of the species have fuscous or soiled secondaries.

*Laudabilis* is always of some shade of green for the ground color, but that is the only character of ornamentation that is constant. The lines vary in situation, in degree of distinctness, somewhat also in course, and the color of the median space is alike in scarcely two specimens of the large series before me. It is a beautiful insect. Besides the green color, the genitalia are constant, and at once distinguish the form. The

harpes are unusually long, the tip sinuate and inwardly prolonged. It is fringed with the usual row of spinules, and has also a small pad of short, stiff bristles at the inside of the extreme tip.

*Marinitincta* is, comparatively, a very constant species, with always a reddish tint to primaries. This replaces the green tint of *laudabilis* and is the only superficial feature I have been able to discover which will separate the two. The genitalia, however, are different. The harpes are not so long, are only slightly dilated at tip, not sinuate nor so much produced inwardly, and without the pad of spinules. All the specimens with the reddish suffusion have this structure, and all the greenish, no matter how like they may be in details of maculation, have the one before described. There is also a peculiar fascies, impossible of description, which separates the two.

*Alboguttata* is distinct. The even, fusco-luteous tint, appearing as though there was a layer of dark over the ground layer of yellow scales, and the prominent white median lines, are characteristic. The male genitalia are very like those of *marinitincta*; but the clasper is somewhat thickened before the tip, and the position, though not the shape, of the harpes is different. There is no confusing this with any allied form.

*Cuneata* is rather larger and broader winged than any of the preceding, with much more constancy in color and maculation. It is rather dark ash-gray, the maculation all distinct, though not contrasting. The s. t. line is marked by a distinct yellow dot near hind angle, and an irroration of yellow scales beyond the reniform is evident in all well preserved specimens. The vestiture is somewhat rough, and the wings are somewhat broader than those of any species save *lorea*, which are referred to this group. It is not easy to mistake, though *brachiolum* of another group may be confounded with it. The genitalia differ from those of the preceding in the more gradual enlargement and larger lappet-like tip, which is truncate and slightly sinuate. The clasper is rather longer and more hook-like; but altogether the species belongs where I have placed it.

The following table will assist in identifying the species:

Secondaries white in both sexes.

Dark gray, evenly colored; t. p. line strongly incurved below reniform, even in course.....INCURVA.

Variable, more or less contrasting; t. p. line lunulate, evenly oblique or sinuate, not incurved below reniform.....4-LINEATA.

Secondaries dusky in both sexes.

Primaries green, gray or blackish.

Median space darker.

Pale gray, with a faint reddish suffusion ..... MARINITINCTA

Green; median space varying from red to black ..... LAUDABILIS.

Median space not darker.

Median lines and ordinary spots contrasting, white marked....ALBOGUTTATA.

Median lines and ordinary spots not white nor contrasting; s. t. line with a yellow spot near hind angle.....CUNEATA.

Primaries reddish yellow or dark luteous; median lines single, brown, distinct; median space usually darker .....LOREA.

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**Mamestra incurva** Smith.1887. Smith, Proc. U. S. Nat. Mus., x, 466; *Mamestra*.

Dark ash gray, median space somewhat darker. Median lines geminate, black but not prominent, included space of ground color. Basal line present, geminate, ending in a short basal black dash. T. a. line with a slight outward curve, only a little sinuate or lunate. T. p. line deeply incurved below the reniform. S. t. line of ground color, accompanied by a dusky defining shade, its course irregularly sinuate. Claviform concolorous, black lined. Ordinary spots defined, of the pale ground color. Orbicular moderate, irregularly rounded. Reniform rather broad and short, its inferior margin absorbed in t. p. line. Near the hind angle the s. t. line is marked by a distinct white spot, emphasized by a blackish line crossing the secondaries at that point. Secondaries white. Beneath, powdery, especially along costa, without lines or dots. Head and thorax like primaries, collar with a black line. Abdomen distinctly tufted.

Expands 25<sup>mm</sup> (1 inch).

HABITAT.—Colorado, Arizona, New Mexico.

A well-marked species, with a strong resemblance to *anguina* in another group. The course of the lines is almost identical and so is the ground color; but the ordinary spots are of a different form and much smaller, and the secondaries in the male are white. The genital structure is that of the group in type, but the harpes have the angle of tip extended as in *leucogramma*, and the clasper is stout, thick, and irregularly twisted, forming two processes from one base. If the maculation were to leave any doubt as to the distinctness of the species, the genitalia would at once dissipate it. With this species *leucogramma* would seem to seek its allies if the sexual characters can be used to associate forms.

**Mamestra 4-lineata** Grt.1873. Grt., Buff. Bull., i, 140, Pl. 4, f. 15 (? *Dianthæcia*).

Ground color somewhat bluish ash-gray, median space darker, often with a reddish suffusion. The lines and spots are as in *laudabilis*. At inferior portion of t. p. line there is always a prominent white shade, and on vein 2, crossing the s. t. line, there is a distinct black dash which is characteristic. The secondaries are white in both sexes, the submedian vein strongly marked with blackish toward the margin. Beneath, powdery, with discal spots but no distinct outer line. Head and thorax like primaries, collar with a black line.

Expands 25 to 27<sup>mm</sup> (1 to 1.08 inches).

HABITAT.—Arizona, California.

Nine specimens are in the Museum series, others among the duplicates: California (J. B. S.); Los Angeles County, California, February, March, April, August, October; Alameda County, California, June, August (through C. V. R.). Red number, 119.

A decidedly variable form, often as distinctly marked as *marinitincta* or even *laudabilis*, with reddish tinted median spaces, and from that form varying to an uniform dark ash-gray with only the white shade on the t. p. line and dark dash on vein 2 distinct. These features, however, seem always present, and in addition to the white secondaries serve to identify the species.

***Mamestra marinitincta* Harv.**

1875. Harv., Buff. Bull., II, 273; *Mamestra*.

1877. Harv., Buff. Bull., III, 6; *Mamestra*.

Ground color pale grayish, with a slight rufous flush; median space darker, blackish fuscous. Lines and spots as in *laudabilis*, from which this species differs only in the ground color and in the sexual characters.

Expands 25–27<sup>mm</sup> (1 to 1.08 inches).

HABITAT.—Texas.

Five specimens are in the Museum collection, all from Texas, October 9–26 (Belfrage coll., O. V. R.).

A comparatively long series of specimens, compared with a much greater lot of *laudabilis*, demonstrates that there is no feature in the maculation of one which is not paralleled in the other. The only constant superficial character is in the ground color, which in *laudabilis* is always green, in *marinitincta* always with a reddish shade. The median space in all the specimens examined is strongly narrowed inferiorly, and the vestiture is more even and less squammosa than in *laudabilis*. It is easy to separate out the species, though it is most difficult to specify wherein the differences consist. The difference in the sexual characters already described is constant.

It is evident, from Dr. Harvey's description, that his type was a form of *laudabilis*. It is equally evident that he considered the form here described as a variety, and in the Belfrage collection this form bears Dr. Harvey's name, and to this form the name must be restricted.

***Mamestra laudabilis* Gn.**

1852. Gn., Sp. Gen. Noct., II, 30, pl. 8, f. 4; *Hecatera*.

1857. Wlk., C. B. Mus., Lep. Het., XI, 511; *Hecatera*.

1874. Grt., Proc. Bost. Soc. Nat. Hist., XVI, 241; *Mamestra*.

1875. Grt., Can. Ent., VII, 27; *Mamestra*.  
*indicans* Wlk.

1857. Wlk., C. B. Mus., Lep. Het., X, 359.

1868. G. & R., Trans. Am. Ent. Soc., II, 78; pr. syn.

var. *ILLAUDABILIS* Grt.

1875. Grt., Can. Ent., VII, 27; *Mamestra*.

1881. Grt., Can. Ent., XIII, 129; *Mamestra*.

Pale sea-green, in cabinet specimens often yellowish; median space varying from reddish brown to black, inferiorly often of ground color. Basal line geminate, black, included space concolorous, sometimes broken, rarely wanting. T. a. line obsoletely geminate, inner part of line often absent, included space whitish. Its course with an outward

tooth above orbicular, inwardly curved over that spot, then outwardly and obliquely curved to hind margin, the curve interrupted by a prominent tooth on internal vein. T. p. line black, lunulate, followed by a more or less evident series of venular dots, indicating the outer part of the line; intervening space paler. The line is outwardly curved over, and inwardly curved beneath reniform. A prominent outward tooth on internal vein. S. t. line pale, punctiform, often hardly traceable, preceded or marked by variably prominent black scales or spots. Sometimes a dusky blotch above hind angle. Fringes cut with black. Ordinary spots distinct, of the green ground-color, outlined in black. Orbicular round, variable in size. Reniform variable in size, constricted at middle. Claviform variable in size and shape. Secondaries whitish to blackish, rather paler at base. Beneath, variable in tint, powdery, with a distinct outer line and discal spots. Head and thorax concolorous with primaries, more or less admixed with black scales.

Expands 25 to 30<sup>mm</sup> (1 to 1.20 inches).

HABITAT.—Washington, District of Columbia, southward and westward to Florida, Texas, and California.

Thirteen specimens are in the Museum series, others in the duplicate material: Washington, District of Columbia, August 6, 21; Selma, Alabama, September; North Carolina, central Missouri, Texas, April 10 (C. V. R.); Texas (Meske); Florida (J. B. S.); California, Santa Cruz Mountains (through C. V. R.).

This is a very variable form. The typical examples have the median space black or dark; the variety *illaudabilis* has it more or less reddish. All intermediate shades are found. The median lines vary somewhat in course, and are variably approximate inferiorly, sometimes almost contiguous, at others widely separated. The only constant characters are in the ground color and course of the t. a. line, and even this latter is not equally marked in all specimens. The sexual characters of the species have been already described. The species is a very handsome one, and appears to be common enough southwardly. The green color is apt to fade and turn to a dingy yellow in the cabinet.

*Mamestra alboguttata* Grt.

1877. Grt., Buff. Bull., III, 85; *Mamestra*.

Sordid fusco-luteous, powdery, median lines geminate, included spaces white. Basal line prominently white. A more or less distinct white blotch between this and t. a. line. T. a. line outwardly oblique, curved, slightly irregular. T. p. line lunulate, about parallel with outer margin, not so distinctly white-marked as is the t. a. line. S. t. line broad, white, interrupted. The s. t. space is unusually narrow and irregularly mottled with paler, blotchy maculation. Claviform outlined, moderate, concolorous. Orbicular small, round, rather paler than median space,

sometimes annulate with white. Reniform upright, moderate in size, somewhat constricted at middle, annulate with white, somewhat lighter than ground color. Secondaries fuscous, toward base paler. Beneath, smoky, powdery, no distinct line or spot. Head and thorax concolorous with primaries, white mottled. Patagiæ white, margined with black.

Expands 27 to 28<sup>mm</sup> (1.08 to 1.12 inches).

HABITAT.—New Mexico, Oregon, California.

A single specimen (New Mexico, J. B. S.) is in the Museum collection.

This is a well-marked species, which can not be easily mistaken. The prominent white lines and peculiar sordid ground color are distinctive. *Variolata* bears some resemblance to it, but belongs to another group with very distinctly different genitalia.

*Mamestra cuneata* Grt.

1873. Grt., Buff. Bull., I, 139, pl. 4, f. 9; *Mamestra*.

1874. Grt., Can. Ent., VI, 156; *Mamestra*.

Ash gray, with fuscous shadings. Median space distinctly fuscous. Median lines distinctly geminate, included space pale. Basal line present, pale, terminating in a lunate black dash. T. a. line with a rather even, outward curve. T. p. line sinuate, essentially parallel to outer margin. S. t. line defined by the somewhat darker terminal space, more or less marked with yellow scales, and with a distinct yellow spot near hind angle. Through the pale s. t. line is a row of black venular dots and a variably distinct fuscous powdering, forming a dark patch on costa. Beyond the reniform in the median space there is an irroration of yellow scales, variably distinct. Claviform concolorous, distinctly outlined, often spanning the median space and connecting the lines. The ordinary spots are large, black-lined, of the pale ground color, and therefore contrasting to the darker median space. Orbicular oval oblique. Reniform kidney-shaped. A row of terminal black lunules. Fringes unusually long. Secondaries dark fuscous. Beneath, smoky fuscous, powdery, with obsolete lines and discal spots. Head and thorax concolorous with primaries, collar with a black line, patagiæ black margined.

Expands 27 to 30<sup>mm</sup> (1.08 to 1.20 inches).

HABITAT.—California, Washington, Vancouver.

Rather broader winged, more robust than any of the preceding, and not to be confounded with them. The large pale ordinary spots, the distinct yellow spot on s. t. line, and the long fringes, are not easily mistaken.

Nine specimens are in the Museum series, others in the duplicate material: California (C. V. R., Meske, J. B. S.); Vancouver (J. B. S.).

**Mamestra lorea** Gn.

1852. Gn., Sp. Gen. Noct., i, 126; *Hydræcia*.  
 1857. Wlk., C. B. Mus., Lep. Het., ix, 161; *Hydræcia*.  
 1874. Grt., Buff. Bull., ii, 13; *Mamestra*.  
 1879. Grt., Can. Ent., xi, 28; *Graphiphora*.  
*Hydræcia ligata* Wlk.  
 1877. Grt., Can. Ent., ix, 28; pr. syn.  
*dodgei* Grt.  
 1875. Grt., Can. Ent., vii, 90; *Mamestra*.

Luteous, with a red or brownish suffusion, median space darker. Median lines single. Basal line very indistinct. Basal space to t. a. line unicolorous, immaculate. T. a. line upright, angulate between veins, sometimes more oblique and slightly curved. T. p. line outwardly bent over reniform, then rigidly oblique to hind margin. S. t. line sinuate, and on costa angulose, concolorous, marked by dusky shades. A fine, terminal brown line. Median space darker than the rest of the wing and sharply defined in most specimens. Ordinary spots of the pale ground-color, the reniform inferiorly dusky. This latter is narrow, upright, outlined with whitish scales. Orbicular moderate in size, round or ovate, brown ringed, sometimes with a few white scales. Claviform rarely traceable, small, concolorous. Secondaries smoky, luteous. Beneath, yellowish, powdery, with distinct outer line and discal dot. Head and thorax concolorous with primaries.

Expands 25 to 31<sup>mm</sup> (1 to 1.24 inches).

HABITAT.—Canada; Eastern, Middle, and Central States, to Nebraska.

A well-marked form, not to be confounded with any in the same group. Color characters have led to its reference to Orthosiid genera, but it seems more properly referable here. *Dodgei*, of which I have seen the type, is a pale variety of this species.

Specimens in the Museum series are: From Long Island, New York, June 21 (J. B. S.); Albany, New York, June 22–26 (Meske); Adirondack Mountains, New York (J. B. S.); Maine; Iowa (C. V. R.).

Group **QUADRANNULATA**.

This group is best characterized in the description of the single species belonging to it.

**Mamestra quadrannulata** Morr.

1875. Morr., Proc. Acad. Nat. Sci., 1875, 430; *Mamestra*.

Sordid, rather dark brownish fuscous, pale along the costal region and internal margin. The median lines are obsolete. S. t. line consisting of a series of small white dots. A dusky terminal line, interrupted by white scales. A distinct black basal line extending nearly to the middle of the wing, and looped at the end to form the small claviform. Ordinary spots small, subequal in shape and size, rounded,

concolorous, outlined in white. Secondaries rather pale fuscous, darker outwardly. Beneath, somewhat glistening, smooth, smoky brown. Abdomen more luteous.

Expands 30 to 32<sup>mm</sup> (1.20 to 1.28 inches).

HABITAT.—Nebraska; Texas.

A very peculiar and easily recognized species, bearing no close resemblance or relation to any other in the genus, and therefore elevated to group rank. The long black basal streak, the small white ordinary spots, and obsolete median lines are characteristic.

A single specimen from the Belfrage material (C. V. R.), marked June 8, is in the Museum collection. The species resembles somewhat *Agrotis plecta* in size, form, and color. The harpes of the male are very slender at base, then suddenly and broadly enlarged at tip and greatly produced inferiorly. The inner side of the tip is fringed with a row of spinules as usual. The clasper is a small, curved, acute hook. It is perhaps the last preceding group to which this structure most allies the species.

Group **INNEXA.**

The wing form, which has been already described, distinguishes this group, which also is best described in the characterization of its single species.

**Mamestra innexa** Grt.

1874. Grt., Buff. Bull., II, 123; *Perigrapha*.

1874. Morr., Proc. Bost. Soc. Nat. Hist., XVII, 214; *Mamestra*.

1875. Grt., Buff. Bull., II, 303; *Mamestra*.

Reddish fuscous, with blue-gray irroration, all the veins marked with gray scales. Median lines single, narrow, gray. Basal line present. T. a. line upright, with a slight inward tooth on median vein. T. p. line very even, almost rigidly oblique from costa to inner margin. S. t. line very distinct, yellowish, rather close to outer margin, its course slightly sinuate. Orbicular round, pale margined, rather darker than ground color. Reniform moderate in size, pale-lined, inferiorly dusky. Claviform wanting. Secondaries of male whitish, with narrow, dark outer margin; of female, dusky, paler at base. Beneath, powdery gray, with an outer line and discal dot. Head and thorax concolorous with primaries.

Expands 28 to 30<sup>mm</sup> (1.12 to 1.20 inches).

HABITAT.—Texas.

Six specimens are in the Museum collection (Meske and C. V. R.), two of them labeled by Mr. Grote, one as *Perigrapha*, the other as *Mamestra innexa*. The specimens from the Riley collection are of the Belfrage material, and are dated March 29, April 29 and 30.

The species is distinct and easily recognizable. The depressed costa, acute apices, and oblique outer margin are distinctive. The basal thoracic tuft and dorsal tufts of abdomen are well marked. The harpes



of the male are broad, emarginate above near tip, which is truncate and inwardly fringed with spines. The clasper is moderate, corneous, and somewhat curved.

Group **PENSILIS**.

Rather narrow winged, ash-gray species, with pointed primaries and evenly oblique outer margins. They are moderately robust in build, the thoracic tuftings are well defined, and the abdomen has dorsal and lateral tuftings, which are most distinct in the male. The male antennæ have the joints somewhat marked and bristled, indicating a relationship of the species to *distincta*, with which they agree in a general way in maculation and habitus.

Two species are rather easily separable from the others by the shape of the claviform, which in *longiclava* really begins at the base of the wing, is discolorous, and reaches the t. p. line. The species is bright gray in color, the margins all darker, the t. a. line not. T. p. line barely traceable below the costa.

In *orbiculata* there is a fine longitudinal black line to the t. a. line, and to this is hooked the concolorous claviform. The t. a. line is indefinite, and the t. p., on the contrary, very distinct, pale, forming a nearly right angle opposite the cell. In color it is dark fuscous gray, the s. t. space darker, giving unusual prominence to the very irregular s. t. line. The ordinary spots are somewhat discolorous, the orbicular narrow, elongate, decumbent.

In the other species the t. a. line is always distinct, and the claviform often extends across the median space, but it does not have any connection with the base of the wing.

Of these *anguina* is at once separable. It lacks all reddish tint, is very dark as a rule, the ordinary spots are large and pale, and the even, strongly-incurved t. p. line is characteristic.

*Vicina* and *pensilis* are nearly alike in maculation; indeed, I have not succeeded in discovering one constant difference of that nature. *Pensilis* is broader winged, usually paler, the male antennæ are thicker, and the ordinary spots are larger; but all these features are relative.

A permanent and actual difference exists in the form of the male genitalia. These are of the same type in both species, but differ in detail. The harpes are broader at base, then suddenly narrowed and angulated and at tip again enlarged, lappet-like, the inner edge of the tip spinulose. The clasper is short, thick, and corneous. In *vicina* the tip is simply somewhat curved and the inferior edge is acutely prolonged and furnished with longer spines. In *pensilis* the lappet is much more ladle-shaped, the edges all rounded and the tip much more curved than in *vicina*. The difference is at once perceived in examining specimens of both species. The clasper in *vicina* tapers to an abrupt point, giving rise to a short beak-like inferior process at its middle. In *pensilis* the clasper has the same inferior process, but in-

stead of being equal to tip the main shank is greatly inflated and almost squarely cut off. A comparison of the figures will bring out these points much better. This is one of the cases where species hardly distinguishable in color and maculation afford good structural differences.

In tabular form the characters described appear as follows:

Claviform attached to a black basal line.

T. a. line vague or wanting.

Claviform pale, discolorous from base; color pale gray with a paler s. t. space; t. p. line indistinct ..... LONGICLAVA.

Claviform concolorous; color dark fuscous gray, s. t. space darker; t. p. line very distinct, even, pale ..... ORBICULATA.

Claviform attached to the very distinct t. a. line.

Basal dash not reaching beyond the basal line.

T. p. line strongly incurved below reniform; claviform moderate. Vestiture velvety in appearance ..... ANGUINA.

T. p. line normally oblique and sinuate, claviform usually crossing median space. Broader winged, usually paler, ♂ antennæ thicker, maculation distinct, ordinary spots larger ..... PENSILIS.

Narrower winged, ♂ antennæ slighter, maculation often indistinct, ordinary spots smaller ..... VICINA.

*Mamestra longiclava*, sp. nov.

Pale whitish gray with an admixture of yellowish hair and scales. Collar inferiorly more yellowish. Patagiæ margined by black scales, most evident at base of the wings. Primaries with the basal lines marked only as geminate, dusky costal spots. T. p. line indicated by a difference in shade between median and s. t. spaces, showing it to be very strongly incurved below cell. A broad wedge-shaped paler gray space starting at the apex, inwardly marked by a dusky costal patch in s. t. space, then widening evenly so as to take in the whole of the s. t. space to hind margin. S. t. line marked by a series of black and ocher yellow scales, beyond which the terminal space is dusky, and a whitish spot strongly marked with black and ocher scales opposite hind angle. The veins are all marked with black and white scales. A dusky terminal line. Fringes yellowish gray, with a dusky central and terminal line. Claviform discolorous, pale, starting at base and extending to the t. p. line, margined with black. Orbicular irregular, oval, oblique, black ringed, with an interior whitish annulus, center with ocherous scales. Reniform large, outwardly diffuse, merging into the pale s. t. shade, inwardly marked by a curved black line, and a broader whitish lunule which is faintly traceable all around the spot. Secondaries whitish, veins and outer margin soiled. Beneath, white, powdery, with a discal spot on all wings.

Expands 30<sup>mm</sup> (1.20 inches).

HABITAT.—Colorado (Bruce).

A single male specimen from Mr. Neumægen's collection. The male genitalia ally this with *anguina*, from which it is widely separated in all other respects. The long discolorous claviform is unique, and the ocher-

ous admixture to the gray scales gives a suggestion of a pink flush which has really no existence. The marginal regions are all darker than the discal.

*Mamestra orbiculata*, sp. nov.

Grayish fuscous, powdered with black scales. Collar, with an im-prominent transverse line. Primaries with basal line pale, not promi-nent. T. a. line pale marked at costa, below this concolorous, marked by geminate black lines, the outer only distinct, outcurved between veins. T. p. line very distinct, narrow, pale, inwardly margined by a narrow, black line, outwardly defined by the dark s. t. space. In its course it forms a distinct, nearly right angle opposite the accessory cell, then inwardly oblique, slightly sinuate to the hind angle. S. t. space darker, emphasizing the irregular pale s. t. line, which is thrice quite deeply angulated inwardly. A row of black venular marks also pre-cedes this line. Terminal space powdered with white; this powdering also more or less evident along the costal region. An interrupted dark, followed by a pale, terminal line. Fringes concolorous. A somewhat indistinct, median shade line, black on costa, outwardly angulate so as to obscure the reniform inferiorly, then indistinct and fuscous to the hind margin. A fine black basal longitudinal line joined to a spear-pointed black-margined claviform. Orbicular oblong or oval, decum-bent, black margined, pale centered, discolorous. Reniform moderate upright, superiorly discolorous, pale yellowish, inferiorly irregularly dilated, marked by a couple of irregular white dots variably placed. Secondaries whitish basally, with an indefinitely bounded outer black-ish fuscous marginal band. Fringes white, with a fuscous interline. Beneath, white, with fuscous powderings, both wings with a broad, outer line, beyond which there is a blackish shade to the margin.

Expands 29 to 30<sup>mm</sup> (1.16 to 1.20 inches).

HABITAT.—Colorado (Bruce).

A very distinct species. The distinct pale, angulated t. p. line, the very distinct, unusually irregular s. t. line, and the discolorous ordi-nary spots are not paralleled elsewhere in the genus. The genital structure is very like that of *brachiolum*, but the tip of the harpes is furnished with spinules, and the clasper is differently shaped.

Two males from Mr. Bruce, one of them in the collection of the U. S. National Museum.

*Mamestra anguina* Grt.

1881. Grt., Can. Ent., XIII, 129; *Mamestra*.

Dark ash-gray, powdery, median space usually somewhat darker, median lines distinct, geminate. Basal line present. T. a. line out-wardly convex, not strongly curved between veins. T. p. line rather even, outwardly curved over reniform, then, with a deep inward curve, narrowing the median space by one-half. S. t. line pale, irregular, sinuate, strongly marked below vein 2, where it is crossed by a dis-

ting black streak. Ordinary spots large, pale, with yellowish or fuscous shading. Orbicular round, black ringed. Reniform kidney-shaped, inwardly black marked, outwardly pale gray, its lower margin touching the t. p. line. Claviform concolorous, not distinctly outlined in any specimen I have seen, spanning the median space. Secondaries of ♂, whitish; of ♀, fuscous. Beneath, powdery, with obsolete outer dark line. Head and thorax concolorous with primaries; collar with a dark line. The harpes of ♂ are broad at base, suddenly narrowed from beneath to half their former width, then equal to the rounded tip, which is inwardly fringed with fine spinules. Clasper rather long, very stout and corneous, not greatly curved.

Expands 29 to 32<sup>mm</sup> (1.16 to 1.28 inches).

HABITAT.—Maine, New Jersey, Illinois, Nebraska, Colorado.

Three specimens are in the Museum collection: Maine, New York (J. B. S.). The specimens differ in the amount of powdery appearance, one of them quite smooth, almost glistening, the others rough. Easily distinguished from the others in this group by the somewhat velvety vestiture, the pale, outwardly somewhat indefinite reniform, and strongly incurved t. p. line. Though placed here with *pensilis*, it would seem more nearly allied to *incurva* of the *laudabilis* group but for the shape of the genitalia.

The species is quite widely distributed, and is, not unlikely, confused with *vicina* in collections.

#### Mamestra vicina Grt.

1874. Grt., Buff. Bull., II, 156; *Mamestra*.

1877. Grt., Can. Ent., IX, 197; *Mamestra*.  
*teligera* Morr.

1874. Morr., Proc. Bost. Soc. Nat. Hist., XVII, 215; *Mamestra*.

1877. Grt., Can. Ent., IX, 197; ? pr. syn.

1881. Grt., Can. Ent., XIII, 129; pr. syn.  
*acutipennis* Grt.

1882. Grt., Can. Ent., XII, 214; *Mamestra*.

1883. Grt., Can. Ent., XIII, 129; *Mamestra*.

Dark ash-gray with a more or less evident rufous tinge, most marked at base and in median space. A longitudinal fine black basal streak, reaching the indistinct basal line. Median lines usually not well marked. T. a. line even, outwardly oblique, with an inward bend below submedian space. T. p. line somewhat irregular, nearly parallel with outer margin, marked with white in submedian space. S. t. line variably distinct, sometimes obsolete, its course very irregular, always marked in submedian interspace with a whitish spot. Claviform outlined in black, usually extending across the median space and connecting the median lines. Ordinary spots concolorous or slightly paler, black ringed and with a narrow interior ring of pale scales. Orbicular oblique, more or less oval. Reniform somewhat variable, but usually more or less kidney-shaped and oblique. S. t. line sometimes preceded

by a more or less evident row of black spots. Secondaries varying in both sexes from soiled white to fuscous. Beneath, powdery gray, with incomplete, or wanting, outer line and discal spot. Head and thorax concolorous, collar with a dark line.

Expands 30 to 32<sup>mm</sup> (1.20 to 1.28 inches).

HABITAT.—Maine to Texas to California.

Seven specimens are in the Museum collection: Sharon, New York, July 23 (Meske); Arizona, Colorado (J. B. S.); Nevada County, California (through C. V. R.). The Nevada County specimens bear the red label 307, and are darker than the others, most nearly resembling the Sharon example, which bears Mr. Grote's own label.

The distinctive features of the species have been sufficiently discussed in the introductory remarks to the group.

#### Mamestra pensilis Grt.

1874. Grt., Pr. Acad. Nat. Sci. Phil., 1874, 199; *Dianthæcia*.

1874. Grt., Can. Ent., vi, 215; *Dianthæcia*.

1881. Grt., Can. Ent., xiii, 129; *Mamestra*.

Like *vicina*, but rather paler, more reddish in ground color with somewhat wider wings; and antennæ of male rather thicker.

Expands 28 to 32<sup>mm</sup> (1.12 to 1.28 inches).

HABITAT.—Texas, Colorado, California, Washington, Vancouver.

Detailed description seems useless, as it would be simply duplicating the description of *vicina*. The only differences have been pointed out.

Four specimens are in the Museum collection: Vancouver (J. B. S.) and Texas, October 7 and 19 (C. V. R., from Belfrage material).

Mr. Grote gives August, September 11, and November as dates of specimens received from Sanzálito, California.

#### SPECIES UNKNOWN TO ME.

#### Mamestra vittula Grt.

1883. Grt., Trans. Kans. Acad. Sci., viii, 48; *Mamestra*.

"Female allied to the Californian 4-*lineata*, the t. a. line not so oblique, and no reddish stain on fore wings; hind wings white, the veins very slightly soiled. Collar gray with blackish edge; thorax blackish gray. Primaries blackish gray. T. a. line scalloped. A black basal dash. Median space shaded with black. Stigmata small, concolorous, dark gray. Terminal field paler gray, preceded by the s. t. line, which is irregular, shaded with black, especially at costa; a black dash at anal angle, before which the s. t. line is bent and heavily marked with black. Beneath, no markings; hind wings white, dusted a little on costa; fore wings pale fuscous. No. 957. Expands 24<sup>mm</sup>."

The specimen is from New Mexico, and does not seem to be distinct from 4-*lineata*, which is variable in the direction indicated in this description.

*Mamestra sutrina* Grt.1881. Grt., *Papilio*, 1, 5; *Mamestra*.

"This species is similarly sized with the Californian *cuneata*, but a little sligher body. It is deep brown, cut and lined with white, and wants all yellowish markings, and is thus differently colored from its ally. It differs in markings by the absence of the dots following the t. p. line and by the white lunulate s. t. line. Lines double, filled in with white. Reniform and orbicular subequal, approximate, white ringed. Claviform outlined in black, beyond it a white spot. A dark line upon submedian fold. Median lines lunulate, uneven, approaching inferiorly. Black interspaceal marks precede the white s. t. line. Half-line marked. T. a. line nearly perpendicular, marked by a black outer line and preceding white shade. T. p. line outwardly bent above, drawn in below vein 4, well removed outwardly. Beneath, fuscous. Hind wings irrorate with whitish, with discal dot and transverse line; above, secondaries with darker border and slightly paler base. Eyes hairy. Body tufted. Expanse ♂ 30<sup>mm</sup>. Colorado."

*Mamestra ferrealis* Grt.1883. Grt., *Can. Ent.*, xv, 29; *Mamestra*.

"Allied to *Mamestra cinnabarina* var. *ferrea*, but larger, bright brown. Orbicular circular, bright brown, with central dot. Reniform upright, very slightly medially constricted, with a central line hooked into two dots. T. p. line double, black, with white included shade. Subterminal space washed with whitish, leaving a brown patch at costa. Terminal space narrow, brown at apex, afterward blackish. Subterminal line whitish, preceded by a narrow brown shading. A blackish shade between the stigma on cell. A blackish shade on costa over subbasal space. Basal half-line white. A broad shade submedially across median space, deepening before t. p. line, where it is cut by the brown median shade. Hind wings fuscous, with extramesial line. Beneath, primaries purply brown, with a black costal shade outside of the common extramesial line. Thorax rather pale, collar and tegulae with black lines. Abdomen tufted, reddish, fuscous, somewhat brighter beneath. Montana. Mr. H. K. Morrison."

*Mamestra dimmocki* Grt.1875. Grt., *Proc. Ac. Nat. Sci.*, 1875, 420; *Mamestra*.

"♀. Allied to *subjuncta* G. and R. Of the same blackish-brown color, differing by being darker and more reddish, by the absence of the median dash, and the want of the prominent W mark to the subterminal line. Collar with a black line. Fore wings with a short distinct black basal dash. Median lines blackish, indistinct, lunulate, approximate. Orbicular large, luniform, excavate on the inner side. Reniform large, medially constricted, shaded with blackish over the median

nervules. Claviform merely outlined. Median shade line ferruginous below the reniform. Subterminal line nearly straight, a series of interspaceal cuneiform ferruginous spots surmounted by pale atoms. Hind wings dark fuscous, with pale fringes. Beneath, thickly powdered with blackish, with a slight ruddy stain. Hind wings, with dot and line.

"Expanse 40<sup>mm</sup>.

"From the White Mountains, New Hampshire. Collected by Mr. Geo. Dimmock, for whom I name the species."

I have already explained how I came to erroneously identify this species, and have named *desperata* the form heretofore named *dimmocki* by me in divers collections, including that of the U. S. National Museum. As above described, I have not yet recognized the species.

#### *Mamestra condita* Gn.

1852. Gn., Sp. Gen. Noct., II, 78, Pl. 8, f. 5; *Aplecta*.

1857. Wlk., C. B. Mus., Lep. Het., XI, 556; *Eurois*.

1874. Grt., Buff. Bull., II, 12; *Mamestra*.

1881. Grt., Can. Ent., XIII, 127 (transl. desc.).

"♀. 35<sup>mm</sup>. The smallest of the genus (*i. e.*, *Aplecta*). Wings slightly elongate, the primaries nearly entire, rather wide, of a grayish white, much powdered with blackish, which makes them griseous, except the edges of the lines and the two ordinary spots, which remain white and empty. The latter are very regular. The orbicular longitudinally ovate. The three first lines very distinct, dentate, black; the t. p. line sending a sharper tooth in the sinus of the reniform. The subterminal very nebulous, pale, margined anteriorly by a vague shade of pale ferruginous; the upper edge of the claviform alone visible. The two median spots separated by a dark spot surrounded by black. A basal ray crosses the half-line. Secondaries dirty yellowish white, with traces of a discal spot, of a much-twisted median line, and of a subanal blackish spot. Terminal marks thick, contiguous, and better marked. Beneath, with the spot and line well indicated, blackish, thick, the line continuous on the primaries. Abdomen short, with small crests. Palpi ascending, slighter than in the other species (*i. e.*, of *Aplecta*)."

The description is copied from Mr. Grote's translation, which I have compared and which is very close indeed. Judging from the figure and description, the species is not a *Mamestra* at all, but is almost certainly *Agrotis trabalis* Grt. I have no specimen of the latter for comparison at present, but I am convinced that this was the species intended by Guenée.

#### *Mamestra impolita* Morr.

1874. Morr., Pr. Bost. Soc. Nat. Hist., XVII, 140; *Mamestra*.

"Expands 35<sup>mm</sup>. Length of body 13<sup>mm</sup>.

"Eyes hairy; male antennæ with fine hairy clothing. Collar gray with a median line. Abdomen strongly tufted. In this species the

lines and spots are arranged as in *chenopodii* Albin, but the markings are more broken, and the squamation is rough and uneven. The ground color is white, almost totally obscured, except in the ordinary spots and on the subterminal space by black or gray shades. The nervules and a portion of the basal space are tinged with glaucous. Half line present. The interior line irregular, simple, obsolete below the claviform spot; the latter round, large, whitish, outlined in black. Above is situated the white, oblique orbicular spot, containing a central gray shade. The submedian nervure is plainly blackish. Median shade blackish, suffused and irregular, lost in the dark median space. Reniform spot white, containing a central gray shade, well sized, unsymmetrical, its defining line broken. The exterior line is black, simple, continuous, dentate, much drawn in below the reniform spot, and forming a particularly deep lobe above the submedian nervure. Subterminal space more or less distinctly whitish below the costa, this color culminating in a very conspicuous white spot, filling the median lobe of the exterior line. The terminal line is whitish, distinct, but somewhat broken, forming two short but evident teeth on the second and third median nervules. The line cuts and divides into two portions the black shades which extend over the terminal and latter part of the subterminal spaces. The usual subapical white dots, and a similar series at the base of the fringe. Posterior wings dark fuscous, becoming lighter and partially translucent at the base; a faint discal dot. The fringes are whitish. Beneath, very uniform in coloration; the anterior wings dark gray; whitish scales line the costa; the posterior wings are whitish, with a distinct discal dot; a common line extends over both wings.

"HABITAT.—Quebec, Canada.

"Kindly lent me for identification by my friend, Prof. F. X. Belanger, of the Université Laval.

"The dark, almost black coloration of the anterior wings contrasting with the four white spots in their central portion is characteristic of the species. Of these spots, two, the orbicular and claviform, are comparatively small and well defined; the remaining two, the reniform and the spot in the lobe of the exterior line, are large and irregular."

The species of Mr. Grote's lists not referred to in this paper do not belong to *Mamestra*, but are better referred elsewhere.

#### SPECIES NOT IDENTIFIED.

##### *Mamestra obliuosa* Wlk.

1858. Wlk., C. B. M., Lep. Het, xv, 1643, *Mamestra*.

"Mas: Cinereo-fusca, subtus cinerea; abdomen cinereum subcrisatum; alæ anticæ lineis subobsoletis denticulatis obscurioribus et albidis, obiculari et reniformi vix determinatis; posticæ cinereæ, margine lato fuscescente."

"Male: Cinereous-brown, cinereous beneath. Abdomen cinereous, slightly crested. Forewings with almost obsolete denticulated darker



brown and whitish lines; orbicular and reniform marks very indistinct, like the lines in color. Hind wings cinereous, with broad brownish borders; fringe of the four wings whitish at the base. Length of the body, 8 lines; of the wings, 18 lines."

"*a.* Rocky Mountains. Presented by the late Earl of Derby."

This description might readily be made to apply to several of our Western species.

***Mamestra associans* Wlk.**

1853. Wlk., C. B. M., Lep. Het. xv, 1683, *Mamestra*.

"Mas: Cinerea; thorax postice nigricante-cinereus, fascia antica interrupta nigra; abdomen rufescens, basi cinereum, fasciculo apicali magno; alæ anticæ rufescentes, costa cinerea nigro notata, lineæ submarginali alba undulata interrupta, orbiculari obsoleta, reniformi nigra sat parva; posticæ pallide cinereæ, marginali fuscescente, subtus apud costam rufescentes nigro subconsersæ."

"Male: Cinereous, paler beneath. Thorax blackish cinereous hindward, with an interrupted black band in front. Abdomen reddish, cinereous towards the base; apical tuft large. Fore wings reddish, cinereous, and with black marks along the costa; submarginal line white, undulating, interrupted; orbicular mark obsolete, reniform black, rather small, somewhat contracted in the middle. Hind wings pale cinereous, with a brownish marginal line; under side reddish, and slightly speckled with black along the costa. Length of the body, 7 lines; of the wings, 16 lines."

"*a.* East Florida. Presented by E. Doubleday, Esq."

***Mamestra septentrionalis* Wlk.**

1865. Wlk., C. B. Mus., Lep. Het., xxxii, 660.

Mas: Fusca; palpi oblique ascendentes, articulo 3° longi-conico; abdominis fasciculis apicalis ferrugineo rufus; alæ anticæ nigro consersæ, striga lata obscuriore orbicularem et reniformem cinereas magnas nigro-marginatas includente; lineis septem e lunulis lunulisque marginalibus nigris, spatio marginali nigricante lineam submarginalem cineream undulatam includente; posticæ cinereæ, fusco marginatæ."

"Male: Brown, cinereous beneath. Palpi obliquely ascending, not rising higher than the vertex; second joint hirsute; third joint elongate conical, about one-fourth of the length of the second. Abdomen brownish cinereous, extending a little beyond the hind wings; apical tuft short, ferruginous red. Femora clothed with long hairs. Fore wings thinly black speckled, with a broad dark brown streak which contains the orbicular and reniform marks; these are cinereous, large, black bordered, and of the usual form; some irregular black lines composed of curves, two near the base, two on the inner side of the orbicular mark, and three exterior, of which the first is interrupted by the

reniform mark; marginal space blackish, including a cinereous undulating submarginal line; marginal lunules black. Hind wings cinereous, very slightly hyaline, brown bordered; discal point and veins brown, marginal line blackish, festooned. Length of the body, 10 lines; of the wings, 20 lines."

"Most allied to *M. insulsa*, from which it may be distinguished by the difference in the orbicular and reniform marks, and in the exterior line of the fore wings."

"a. Vancouver's Island."

*Mamestra expulsa* Wlk.

1865. Wlk., C. B. M., Lep. Het. xxxii, 661, *Mamestra*.

"Foem: Nigricante-cinerea, nigro conspersa; palpi oblique ascendentes, articulo 3° longo-conico; atæ anticæ lineis tribus nigris angulosis duplicatis, orbiculari et reniformi magnis nigro-marginatis, spatio intermedio nigricante, linea submarginali cinerea angulosa; posticæ, cinereæ fusciscente marginatæ."

"Female: Blackish cinereous, black speckled, cinereous beneath. Palpi obliquely ascending, extending rather beyond the head. Third joint elongate-conical, about one-third of the length of the second. Antennæ very minutely setulose. Abdomen cinereous, extending somewhat beyond the hind wing. Forewings with three double zigzag black lines; first line very near the base; second on the inner side of the orbicular mark, which is large and black-bordered, and has a blackish space between it and the reniform; the latter is broad, black-bordered, on the inner side of the third line; submarginal and marginal lines cinereous, the former zigzag; hind wings cinereous, brownish along the exterior border. Length of the body 9 lines; of the wings 18 lines."

"Allied to *M. insulsa*, but the submarginal line is more undulating and less denticulated."

"a. Vancouver's Island."

*Mamestra punctigera* Wlk.

1865. Wlk., C. B. M., Lep. Het. xxxii, 661, *Mamestra*.

"Mas: Nigra; palpi vix ascendentes, articulo 2° fimbriato, 3° longiconico; antennæ dense setosæ; abdomen obscure cinereum, orbiculari et reniformi albido punctalis atro marginatis; posticæ cinereæ, lunula venis fasciæ marginali diffusæ fusciscentibus."

"Male: Black, cinereous beneath. Palpi very slightly ascending, extending rather beyond the head; second joint fringed beneath; third elongate-conical, about one-fourth of the length of the second. Antennæ stout thickly setose. Abdomen dark cinereous, extending a little beyond the hind wings. Wings with a whitish line on the base of the fringe. Forewings with whitish points along the costa; orbicular and

reniform marks bordered with deep black, containing whitish points; orbicular almost round; reniform of the usual shape. Hind wings cinereous; lunule, veins, and a diffuse marginal band brownish. Length of the body 9 lines; of the wings 22 lines."

"The pale marginal line of the forewings distinguish it from *M. impulsæ*."

"a. Vancouver Island."

*Mamestra vetusta* Wlk.

1865. Wlk., C. B. M., Leg. Het. xxxii, 662, *Mamestra*.

"Foem: Oana; caput rufescente notatum; palpi porrecti, extas nigro notati, articulo 3<sup>o</sup> lanceolato; pectus rufescens; alæ anticæ latæ, lineis nonnullis e lunulis indistinctis fuscis, linea basali angulata, liturisque costalibus nigris, orbiculari et reniformi albidis magnis nigro submarginatis; posticæ æneo suffusæ."

"Female: Hoary, dingy beneath. Head with a tranverse reddish mark between the antennæ. Palpi porrect, extending a little beyond the head; second joint pilose, partly black on the outer side; third lanceolate, hardly one-third the length of the second. Pectus reddish. Abdomen extending a little beyond the hind wings. Legs black-speckled; spurs whitish, with a black band; tarsi spinose, their joints black towards the base. Wings broad. Forewings with some brown indistinct lines composed of lunules, and with black marks along the costa; a deeply angular black line near the base; orbicular and reniform marks large whitish, incompletely blackbordered; marginal festoon black. Hind wings with an æneous tinge. Length of the body 10 lines, of the wings 24 lines."

"a. Vancouver's Island."

*Hecatera Strigicollis* Wallengr.

1860. Wallengr., Wien. Ent. Monatschr., iv, 170.

"Alis anticis supra albidis, spatio basalis ochraceo fuscoque marmorato, spatio intermedio ferrugineo-fusco, maculis cellulae 2 ordinariis albis, margineque exteriore extra lineam subterminalem undulatam cano; posticis griseis disco pallidioribus; collari ferrugineo, linea nigra transversa margineque canescente. ♂."

California. Mus. Holm. Statura *H. serena*.

LIST OF SPECIES OF MAMESTRA.

1. *disalis* Grt.
2. *rogenhoferi* Mœschl.
3. *nimbosa* Gn.
4. *imbrifera* Gn.
5. *purpurissata* Grt.  
var. *juncimacula* Smith.

6. *insolens* Grt.  
*arietis* Grt.  
*earina* Morr.
7. *leucogramma* Grt.
8. *lepidula* Smith.
9. *determinata* Smith.

## LIST OF SPECIES OF MAMESTRA—Continued.

10. *meditata* Grt.
11. *lustralis* Grt.
12. *detracta* Wlk.  
*claviplena* Grt.
13. *gnata* Grt.
14. *distincta* Hbr.  
*citis* French.
15. *crotchii* Grt.  
var. *fusculeuta* Smith.
16. *farnhami* Grt.
17. *liquida* Grt.
18. *capsularis* Gn.  
*propulea* Wlk.
19. *vittula* Grt.
20. *prodeniformis* Smith.
21. *atlantica* Grt.  
*W-latinum* † Gn.  
*discolor* Speyer.  
*dissimilis* † Butl.
22. *desperata* Smith.
23. *canadensis* Smith.
24. *nevadæ* Grt.
25. *subjuncta* G. and R.
26. *grandis* Boisd.  
*libera* Wlk.
27. *invalida* Smith.
28. *trifolii* Rott.  
*chenopodii* Fabr.  
*albifusa* Wlk.  
*oregonica* Grt.  
*major* Speyer.  
var. *marmorosa* Bkh.
29. *u-scripta* Smith.
30. *rosea* Harv.
31. *congermana* Morr.
32. *vindemialis* Gn.  
*rubefacta* Morr.
33. *picta* Harv.  
*exusta* Gn.  
*contraria* Wlk.
34. *u-album* Gn.
35. *cristifera* Wlk  
*lubens* Grt.  
*rufula* † Morr.  
*brassicæ* † Grt.
36. *assimilis* Morr.  
var. *pulverulenta* Smith.
37. *latex* Gn.  
*demissa* Wlk.
38. *passa* Morr.
39. *adjuncta* Bdv.
40. *variolata* Smith.
41. *glacata* Grit.
42. *minorata* Smith.
43. *defessa* Grt.
44. *chartaria* Grt.
45. *repentina* Morr.
46. *brachiolum* Harv.
47. *beanii* Grt.
48. *legitima* Grt.
49. *lilacina* Harv.  
*illabefacta* Morr.
50. *rugosa* Morr.
51. *noverca* Grt.
52. *goodellii* Grt.
53. *quadrata* Smith.
54. *obscura* Smith.
55. *ectypa* Morr.  
*bella* Grt.
56. *renigera* Steph.  
*herbimacula* Gn.
57. *egens* Wlk.  
*stricta* Wlk.  
*ferrea* Grt.  
var. *cinnabarina* Grt.
58. *spiculosa* Grt.
59. *circumcincta* Smith.
60. *olivacea* Morr.  
*comis* Grt.  
var. *obscurior* Smith.
61. *rectilinea* Smith.
62. *vau-media* Smith.
63. *incurva* Smith.
64. *4-lineata* Grt.
65. *marinitincta* Harv.
66. *laudabilis* Gn.  
*indicans* Wlk.  
var. *illaudabilis* Grt.
67. *alboguttata* Grt.
68. *cuneata* Grt.
69. *lorea* Gn.  
*ligata* Wlk.  
*dodgei* Grt.
70. *quadrannulata* Morr.
71. *innexa* Grt.
72. *longiclava* Smith.
73. *orbiculata* Smith.
74. *anguina* Grt.
75. *vicina* Grt.  
*telligera* Morr.  
*acutipennis* Grt.
76. *pensilis* Grt.  
(unknown to me.)
77. *vittula* Grt.
78. *eutrina* Grt.
79. *ferrealis* Grt.
80. *condita* Gn.
81. *impolita* Morr.

## LIST OF SPECIES OF MAMESTRA—Continued.

- |                                 |                            |
|---------------------------------|----------------------------|
| 82. <i>dimmocki</i> Grt.        | 86. <i>punctigera</i> Wlk. |
| 83. <i>strigicollis</i> Wall.   | 87. <i>vetusta</i> Wlk.    |
| 84. <i>expulsa</i> Wlk.         | 88. <i>obliviosa</i> Wlk.  |
| 85. <i>septentrionalis</i> Wlk. | 89. <i>associans</i> Wlk.  |

## EXPLANATION OF PLATES VIII-XI.

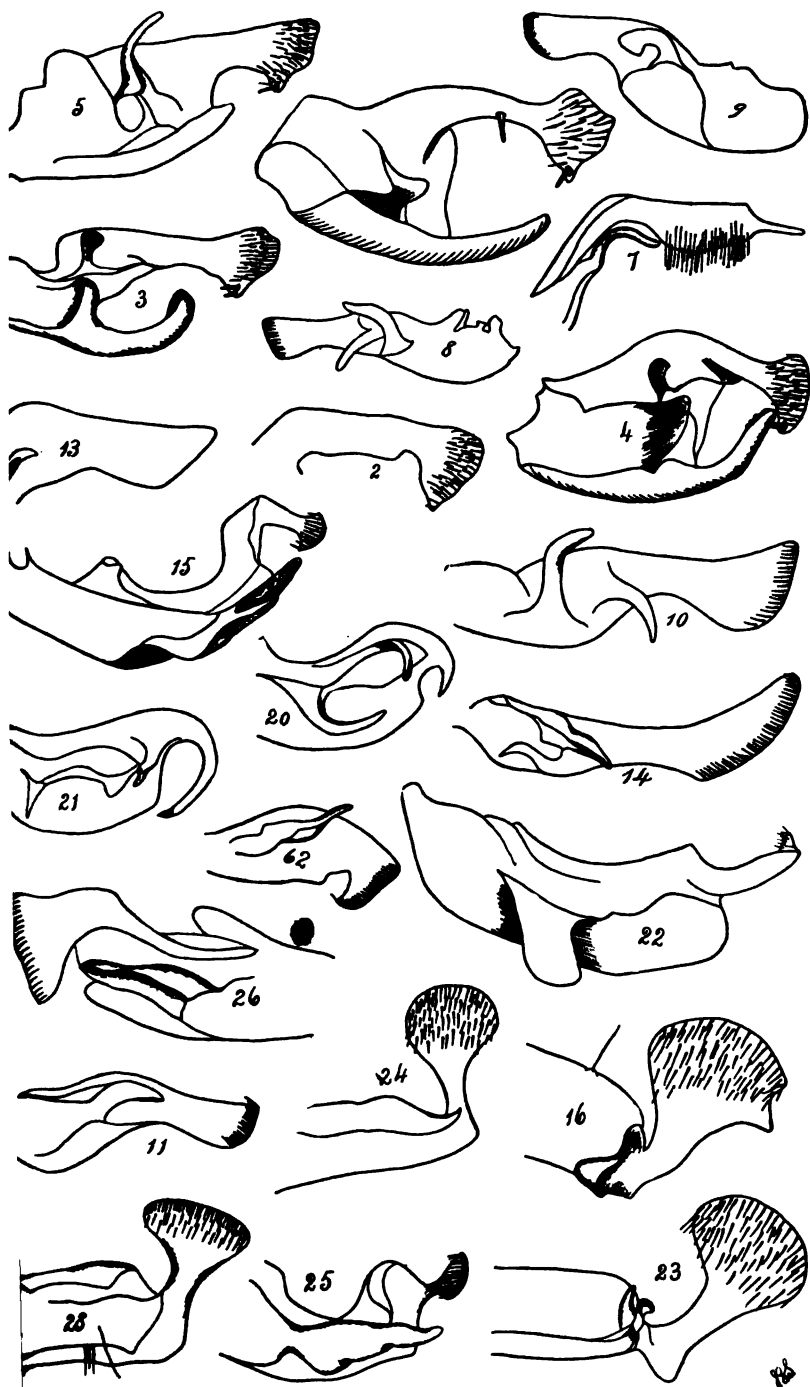
The figures are numbered consecutively, but are not regularly arranged on the plates.

## Harpe and clasper of—

1. *M. discalis*.
2. *M. rogenhoferi*.
3. *M. nimbosa*.
4. *M. imbrifera*.
5. *M. purpurissata*.
6. *M. insolens*.
7. *M. leucogramma*.
8. *M. determinata*.
9. *M. lepidula*.
10. *M. meditata*.
11. *M. lustralis*.
12. *M. detracta*.
13. *M. gnata*.
14. *M. distincta*.
15. *M. crotchii*.
16. *M. liquida*.
17. *M. capsularis*.
18. *M. vittula*.
19. *M. prodeniformis*.
20. *M. atlantica*.
21. *M. canadensis*.
22. *M. desperata*.
23. *M. subjuncta*.
24. *M. grandis*.
25. *M. trifolii*.
26. *M. desperata*.
27. *M. rosea*.
28. *M. congermana*.
29. *M. rindemialis*.
30. *M. picta*.
31. *M. cristifera*.
32. *M. assimilis*.
33. *M. latex*.

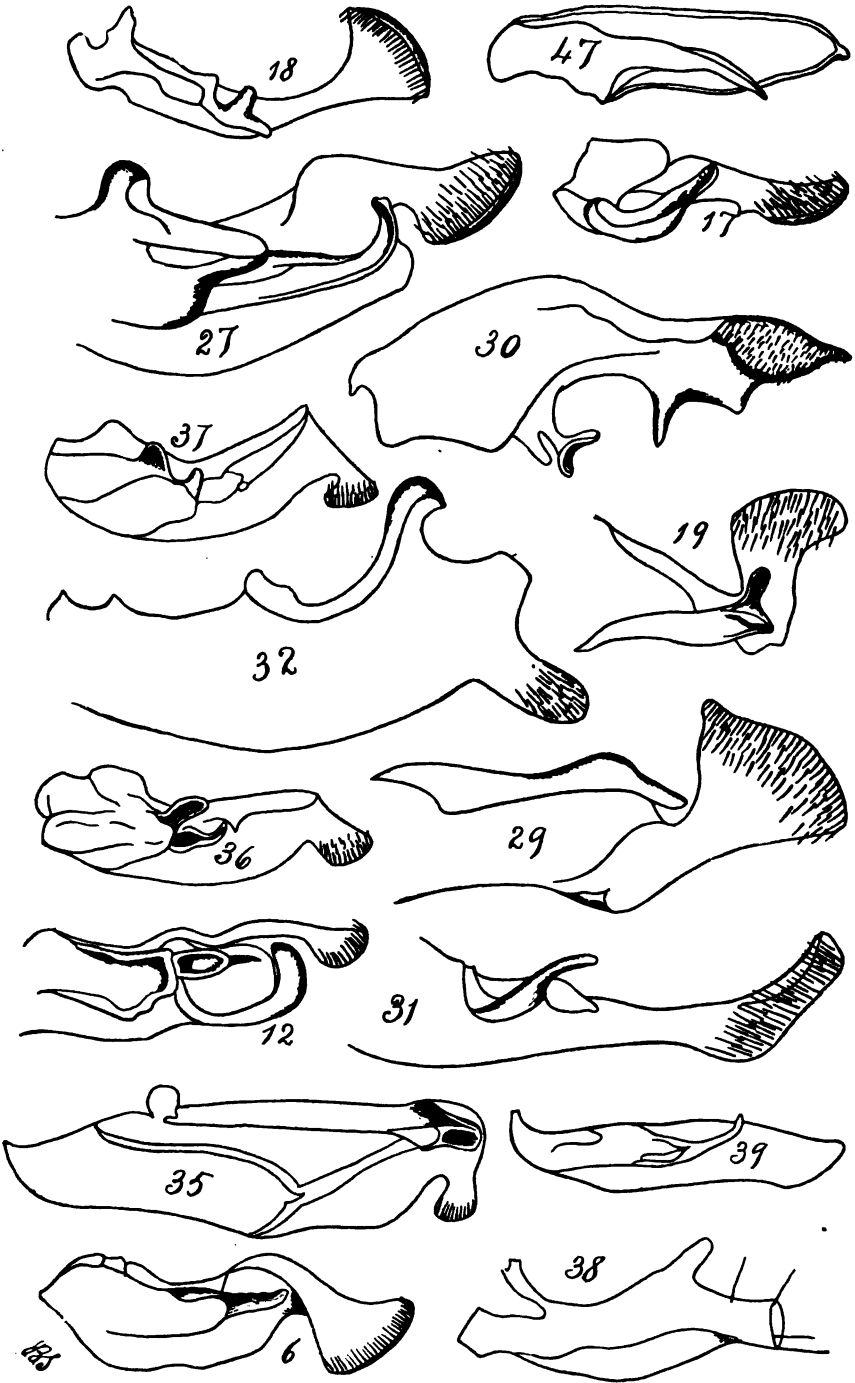
## Harpe and clasper of—

34. *M. adjuncta*.
35. *M. variolata*.
36. *M. glaciata*.
37. *M. minorata*.
38. *M. chartaria*.
39. *M. brachiolum*.
41. *M. legitima*.
42. *M. lilacina*.
43. *M. rugosa*.
44. *M. noterca*.
45. *M. goodellii*.
46. *M. quadrata*.
47. *M. obscura*.
48. *M. ectypa*.
49. *M. renigera*.
50. *M. egens*.
51. *M. spiculosa*.
52. *M. circumcincta*.
53. *M. olivacea*.
54. *M. incurva*.
55. *M. 4-lineata*.
56. *M. marinitincta*.
57. *M. laudabilis*.
58. *M. alboguttata*.
59. *M. cuneata*.
60. *M. lorea*.
61. *M. quadrannulata*.
62. *M. innexa*.
63. *M. anguina*.
64. *M. longiolava*.
65. *M. vicina*.
66. *M. pensilis*.



GENITAL STRUCTURE OF MAMESTRA.

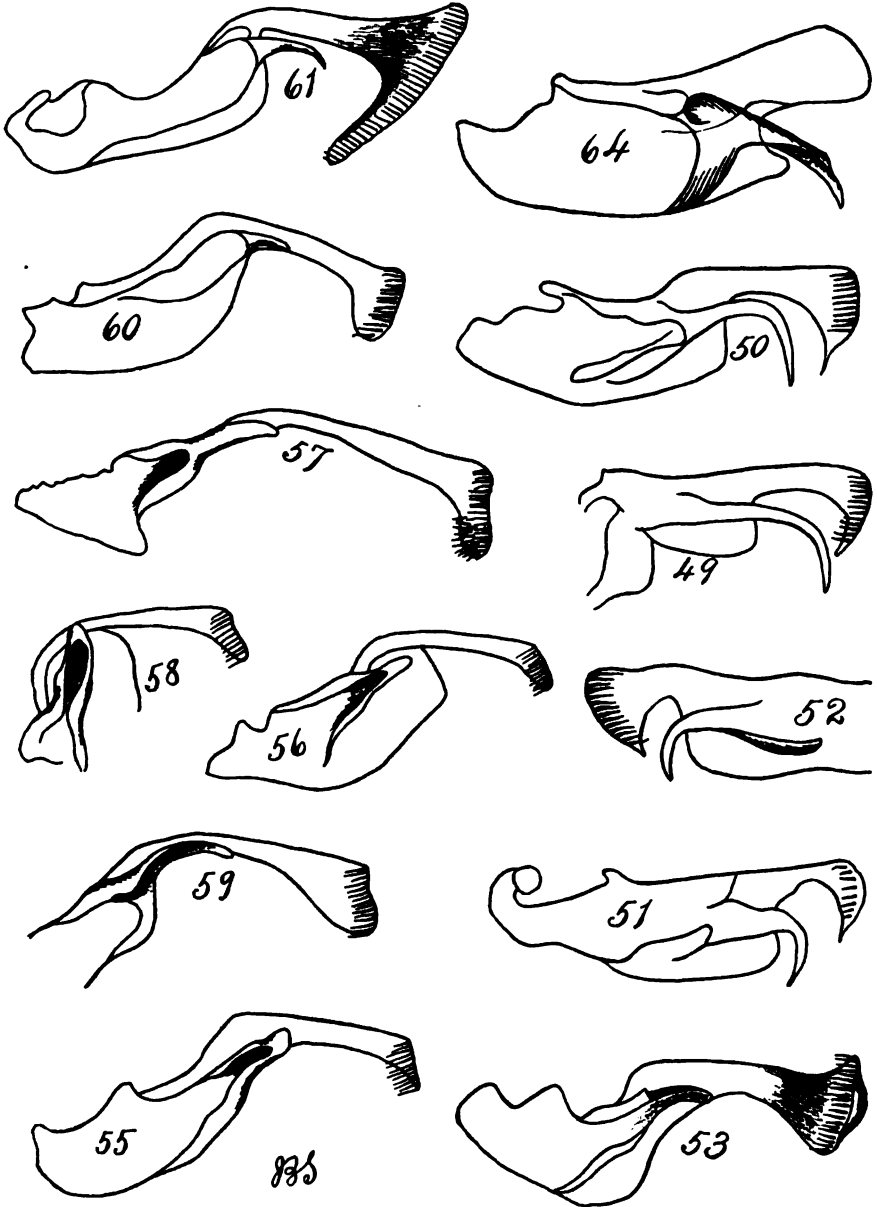




GENITAL STRUCTURE OF MAMESTRA.

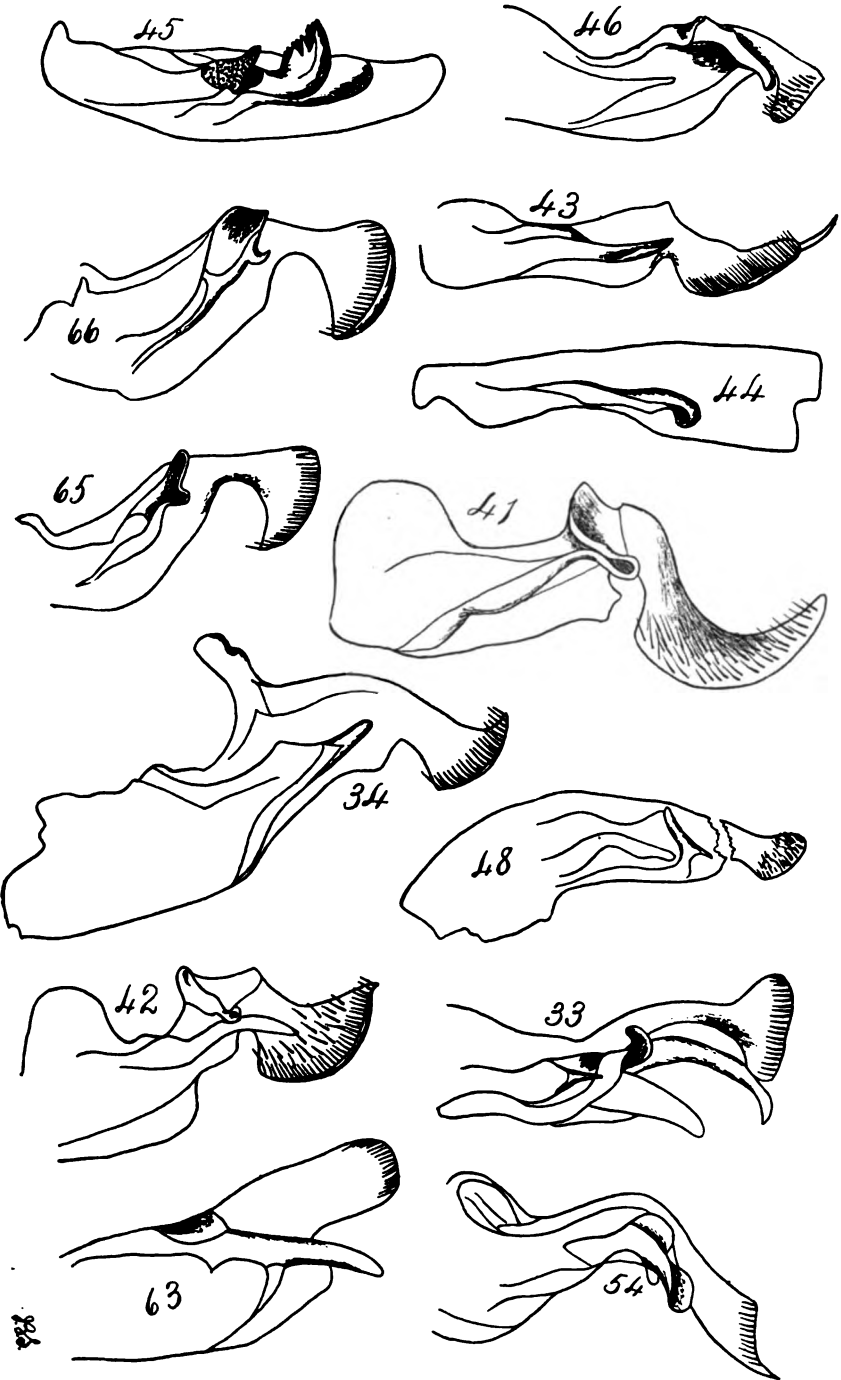






GENITAL STRUCTURE OF MAMESTRA.





GENITAL STRUCTURE OF MAMESTRA.



REPORT UPON THE ANNELIDA POLYCHÆTA OF BEAUFORT,  
NORTH CAROLINA.

BY

E. A. ANDREWS, PH.D.

(With Plates XII-XVIII.)

The Annelid fauna of the northeastern coast of the United States has become so well known through the labors of A. E. Verrill, H. E. Webster, and others, that our ignorance of that of the southern Atlantic States is the more striking by contrast. South of Northampton County, Virginia, where Webster, in 1874 and 1876, obtained some fifty-nine species of Polychæta, described in his *Annelida Chætapoda* of the Virginian coast, but very little has been published respecting the littoral Annelid fauna, though the European descriptions of forms collected in the West Indies, the collection of Professor Goode in Bermuda of twenty-six species, described in the *Bulletin* of the U. S. National Museum, 1884, and the extensive monograph of Ehlers on the Annelids dredged by the Coast Survey steamer *Blake* off the Florida coast (*Mem. Mus. Com. Zoöl.*, Harvard, 1887) give a few general grounds for anticipating some of the discoveries to be expected along the shores of the Southern States.

In this region, Charleston Harbor was carefully examined by the French naturalist, L. A. G. Bosc, toward the close of the last century, with the result that several interesting Annelids were made known, among them being the new genus *Polydora*. Later Stimpson (*Proc. Boston Soc. Nat. Hist.*, 1856) described two new Annelids from this same interesting locality, one being the remarkably large *Acoetes lupina*. Farther north, at Fort Macon, near Beaufort, North Carolina, Coues and Yarrow collected marine Annelids, nine species of which were described by Verrill in 1878 (*Proc. Acad. Nat. Sci. Phila.*).

In the following list some fifty-seven species, representing twenty-four families of Polychætous Annelids, are identified and described, with such notes upon breeding, habits, color, etc., as were made at that time, the collection being obtained in connection with the Johns Hopkins Marine Laboratory, Beaufort, North Carolina, in the summer months of 1884 and 1885. As the collection was confined to a short part of the year, was for the most part limited to the area between tides, and not conducted with any great thoroughness, the list must obviously give but

an inadequate idea of the richness of the fauna. Reinvestigation would doubtless show the fauna to be as well represented by numerous species, as it obviously is by innumerable individuals, the sand flats presenting a most striking illustration of the wealth of Annelid life that may be supported under the exceptionally favorable conditions here prevailing.

### Family AMPHINOMIDÆ.

#### **AMPHINOME** Brugnieres.

##### *Amphinome rostrata* Quatrefages.

QUATREFAGES. Hist. Nat. des Annelis, vol. 1, p. 393.

Small and apparently immature specimens of *Amphinome* were found on several occasions among the stalked barnacles upon driftwood brought into the harbor by certain winds, and referred, with considerable doubt, to the form *Quatrefages* seems to have had for the above description.

The coloring of the body suggests a protective resemblance to the stalks of the barnacles among which the Annelid lies concealed, though Langerhans thinks that the conspicuous colors of certain members of this family are useful as a warning signal, some having, he says, poisonous setæ.

### Family POLYNOIDÆ.

#### **LEPIDONOTUS** (Leach) Malmgren.

##### *Lepidonotus sublevis* Verrill.]

VERRILL. Invert. Animals, Vineyard Sound, p. 320, 581, Pl. x, Fig. 42.

VERRILL. New England Annelida, Part I, Pl. vi, Figs 4, 4a, 4b, 4c.

Small specimens are not uncommon in material dredged in shallow water, both inside and outside of the inlet, and were taken both in 1884 and 1885.

##### *Lepidonotus variabilis* Webster.

WEBSTER. Annel. Chæt. Virginian Coast, p. 58, Pl. vii, Figs. 6-11; Pl. ii, Figs. 12-14.

This occurs upon oyster shells, etc., in shallow water. It was taken at "Green Rock," in June, among hydroids; upon the bottom of a floating scow, off Schackelford Bank, in August; near "Horse Island," and among sponges dredged near Moorhead City, in June.

#### **HARMOTHÖE** Malmgren.

##### *Harmothoe aculeata*, sp. nov.

(Plate XII, Figs. 1-5.)

Body long, much flattened; setigerous somites, 34. Cephalic lobe deeply cleft. The two lobes swollen and with the acuminate tips sharply distinguished. Anterior eyes larger than posterior, opposite posterior end of median cleft. Median tentacle more than twice the length of the

antennæ; the latter slender, not much exceeding cephalic lobe. Tentacular cirri more slender than tentaculum. Palpi much stouter and smooth, unless highly magnified.

First pair of elytra round; following ones oblong, somewhat wider at outer part and emarginate on anterior edge; outer and posterior edges with dense fringe; surface covered with spines, which are small and surrounded by a circular area on the smooth anterior region, while they become larger, sharp, and surrounded by polygonal areas upon the posterior part of the elytra. Here the polygonal areas bear smaller spines or nodules near the edge. The large spines as well as small ones are often bifid and form near posterior edge of elytrum a linear series evident to naked eye.

Dorsal cirri, tentaculum, and antennæ densely papillated, but ending in smooth filiform tips. Ventral cirri small, slender, somewhat papillated. Dorsal setæ as in *H. imbricata* Malmgren. Ventral setæ with nearly straight tips and prominent hooks some distance below.

Length up to 2 centimetres; diameter, including setæ, 8 millimetres.

The most common scale-Annelid found under stones, etc., in shallow water and between tides, near the town. It was also dredged among sponges near Horse Island and at Green Rock, in June and October.

#### **NYCHIA** Malmgren.

##### ***Nychia cirrosa*** Malmgren.

MALMGREN. Nordiska Hafs-Annulata, p. 53, Pl. VIII, Fig. 1.

WEBSTER. Annel. Chæt., Provincetown, p. 700.

TAUBER. Annulata Danica, pp. 79-80.

Only one specimen was taken, 1884.

#### **LEPIDAMETRIA** Webster.

##### ***Lepidametria commensalis*** Webster.

WEBSTER. Annel. Chæt. Virginian Coast, pp. 10-13, Pl. III, Figs. 23-31.

WEBSTER. Annel. Chæt., Provincetown, p. 701.

Only a single specimen of this interesting commensal annelid was taken in the tube of an amphitrite, found in the mud flat alongside the channel at Crab Point, in June, 1885.

#### Family **SIGALIONIDÆ**.

##### **STHENELAIS** Kinberg.

##### ***Sthenelais picta*** Verrill.

VERRILL. Invert. Anim. of Vineyard Sound, p. 348, 582.

VERRILL. New England Annelida, part 1, Pl. VII, Fig. 3; Pl. VI, Fig. 7. Proc. U. S. Nat. Mus., vol. II, p. 167.

WEBSTER. Annel. Chæt. of Virginian Coast, p. 13.

WEBSTER. Annel. Chæt., Provincetown, p. 701.

This fine Annelid occurs in the sand between tides on Bird Shoal and was often dug in 1884 and 1885 at various periods of the summer and early fall.



## Family ACETIDÆ.

**ACETES** Aud. and M. Edw.**Acetes lupina** Stimpson.

STIMPSON. On some remarkable marine invertebrata inhabiting the shores of South Carolina, Proc. Boston Soc. Nat. Hist., vol. v, pp. 116, 117.

QUATREFAGES. Histoire naturelle des Annelis, vol. II, p. 674.

Of this remarkably large scale-annelid only two specimens were taken at periods of unusually low tide in July, 1885, both in muddy, somewhat grassy, areas exposed but imperfectly and for a short period. One was found in "Shark Shoal," the other with amphitrite on the edge of Crab Point Thoroughfare. The greatest length is 24 inches. The other specimen measures 16 inches, with a diameter including parapodia of 14 millimetres at the fortieth somite. The elytra are about one hundred and thirty-eight on each side, smoky black with white yellow edges; they cover the parapodia, but leave dorsal surface mostly uncovered.

General color reddish brown, lurid, not translucent, anterior 2 inches of dorsal side whitish; ventral median vessel purple. In the smaller individual taken on Shark Shoal the color is markedly lighter and more variegated.

Dorsal cirri end in acute white cones, ventral cirri small and dark red. On ventral side of parapodium several transparent elevations are noticeable anteriorly, but gradually disappear towards the posterior part of the body.

At the posterior end the body is transparent and bears flake-white anal cirri.

There can be no doubt that this is the same Annelid that Stimpson found in Charleston Harbor—agreeing as it does in all the essential characters he gives.

The larger specimen discharged great quantities of spermatozoa from openings anterior and ventral to the ventral cirri.

The peculiar tubes, suggesting those of *cerianthus* very forcibly, are one-fourth of an inch thick, made of concentric layers of tough membranous substance and inclose a lumen one-half inch wide. These tubes stand vertically in the soft mud and extend down more than two feet.

Microscopic examination of the tube shows that the layers of membrane are formed of long, yellow fibrils looking like *chitin* and identical with those figured and described by Eisig (*die capitelliden*) as secreted by Polyodontes.

## Family NEPHTHYDIDÆ.

**NEPHTHYS** Cuv.**Nephtys buccera** Ehlers.

EHLERS. Die Borstenwürmer, p. 617, Pl. xxiii, Fig. 8.

VERRILL. Invert. An. Vineyard Sound, pp. 416, 583, Pl. xii, Fig. 58.

WEBSTER. Annel. Chæt., Provincetown, p. 702.

Not uncommon in the sand of various shoals, especially upon the outer parts scarcely uncovered at low water.

***Nephtys picta* Ehlers.**

EHLEERS. Die Borstenwürmer, p. 632, Pl. XXIII, Figs. 9, 35.

VERRILL. Invert. An. Vineyard Id., pp. 348, 553, Pl. XII, Fig. 57.

WEBSTER. Annel. Chæt. of Virginian Coast, p. 14.

This form would seem less common than the former with which it sometimes occurs.

**Family PHYLLODOCIDÆ.****PHYLLODOCE (Sav.) Malmgren.*****Phyllodoce fragilis* Webster.**

WEBSTER. Annel. Chæt. of Virginian Coast, p. 14, Pl. III, Figs. 32-37.

This conspicuous small Annelid was found in considerable numbers in material dredged in shallow water in Bogue Sound and near Horse Island in June.

**Family HESIONIDÆ.****PODARKE Ehlers.*****Podarke obscura* Verrill.**

VERRILL. Invert. An. of Vineyard Id., pp. 319, 589, Pl. XII, Fig. 61.

WEBSTER. Annel. Chæt. of Virginian Coast, p. 16.

A small active Annelid, which like the former species and many other forms, emerges in numbers from masses of sponge, shell, etc., allowed to stand in water till it becomes impure. Dredged off Moorhead City in abundance.

**Family SYLLIDÆ.****SYLLIS (Sav.) Ehlers.*****Syllis spongicola* Grube.**

GRUBE. Archiv. f. naturgeschichte, 1855, Part 7, p. 104, Pl. IV, Fig. 4.

MARION & BOBRETZKY. Annel. du Golfe de Marseille, Ann. Sci. Nat. Zool., 6 ser., vol. 2, 1875, pp. 24-25, Pl. II, Fig. 7.

LANGERHANS. (*Haploeyllis hamata*). Die Wurmfauna von Madeira. Zeit. f. wiss. Zool., vol. 32, pp. 527-528.

The small Annelid identified as above, occurred in large numbers in sponges dredged off Moorhead City, in shallow water, June.

**PÆDOPHYLAX Clpd.*****Pædophylax longiceps* Verrill.**

VERRILL. Proc. U. S. Nat. Mus., vol. 11, 1879, pp. 170, 171. New England Annelida, Part 1, Pl. XII, Fig. 2.

LANGERHANS. Die Wurmfauna von Madeira, Zeit. für wiss. Zool., vol. 40, p. 243, Pl. XV, Fig. 2.

Sexual individuals were taken in the dip net. Eggs and young were observed in most of the stages described by Vigueir for *Exogone gemmi-*

*fera* Pag. to which they present great similarity. The eggs or young were attached ventrally to about 16 segments, commencing usually on the fifteenth, but in 11 specimens studied considerable variability was observed. In most cases no elongated setæ were present upon the segments bearing young.

**AUTOLYTUS** (Grube) Marenzeller.

*Autolytus varians* Verrill.

VERRILL. New England Annelida, p. 320.

Sexual forms, ♂ and ♀, were taken at the surface, which are probably identical with the forms described by Professor Verrill from the New England coast, June.

**PROCHÆA** (Ehlers) Marenzeller.

*Proceræa tardigrada* Webster.

WEBSTER. Annel. Chæt. of Virginian Coast, pp. 27-30.

Non-sexual forms, many of them in process of division, were dredged in great numbers amongst sponges, near Green Rock, in 3 to 4 fathoms, and sexual forms were taken in the tow net. From a comparison of these various forms there seems no doubt that the *Proceræa cerulea* of Webster was merely the female of *P. tardigrada*, the eggs of which are of a sky-blue color and give this color to the body before they are laid. Subsequently they are carried about in three delicate sacks on the abdomen, between the sixth and thirty-second segments.

This ♀ has a dark dorsal, transverse band upon somites, 3, 6, 8, 9, 13, 17, 21, 25, 27, 29, 32, 35, 38, 42, 46, 49, 51, 53, 56, 57, 70, 71, 74, and 77, near anterior edge of each. Each parapodium bears ventrally a dark-red spot. The large lateral and swollen dorsal eyes are concealed by pigmented areas. Base of dorsal cirrus red as far as twenty-fourth somite. Body convex dorsally, flat ventrally, and laterally expanded with long parapodia, setæ and dorsal cirri in the region between sixth and twenty-seventh somites. Taken in August. The nonsexual form has pigmental bands like those of the ♀ but arranged according to a definite law or general rule to which the bands in the ♀ conform also; bearing in mind that the ♀ is formed as a cut-off part of the nonsexual stage, separating almost always just posterior to thirteenth somite and hence having thirteen less somites than that stage. In one hundred and ten individuals carefully studied only three had the bud formed just posterior to fourteenth somite; seventy-nine had an evident bud just posterior to thirteenth somite.

Having tabulated the arrangement of the colored bands in these one hundred and ten individuals there results the general rule that the bands occur upon the third and fourth somites, then upon every other or alternate one up to and including the twelfth, then (in the region of

the bud) upon every fourth one up to and including the twenty-fifth, then upon every fifth one up to and including the forty-first, after which the exceptions become so numerous that no rule is evident.

The examination of so many cases shows a definite tendency to limitation in the bands to certain somites in the anterior region and a greater and greater irregularity in the posterior region. The oldest region in each individual of the two concerned in budding is remarkably constant in respect to the coloration. Thus in the one hundred and ten cases studied the *nurse* or anterior thirteen somites presented abnormal bands as follows: On the fifth somite a band in only eleven cases; on the seventh none at all; on the ninth in only four cases; on the eleventh in only six cases; on the thirteenth in only five cases. On the fourth somite the normal band was wanting in four cases, never on the third somite. The rule of banding in the bud is not as strictly adhered to as in the above nurse. Thus bands occur abnormally upon the fourteenth somite in fifteen cases, are wanting upon the fifteenth in thirteen cases, occur upon the sixteenth in eight cases, upon the seventeenth in twenty cases, are wanting upon the eighteenth in twenty cases, and so on.

These facts seem sufficient to indicate that we have in this Syllid a marked tendency to the acquirement of a regular metameric marking, which, however, does not coincide with the metamerism of the somites but tends to follow a special law, best expressed in the oldest part of the body in which certain alternating colored and not colored somites are distinguishable—a series of groups or combinations of somites thus following one another.

In one case, a nonsexual individual with well-advanced bud, the posterior zoöid was inverted Y shaped, being provided with two complete but not quite identical posterior ends; an abnormality previously noticed in various Annelids by many observers, but in this case striking from the length of the divided region and the activity of these two parts in the crawling movements of the whole.

*Proceræa ornata* Mar. and Boby.

MARION AND BOBRETZKY. Annel. du Golfe de Marseille > Ann. Sci. Nat., 6th ser., vol. 2, pp. 44-46, Pl. v, Fig. 14.

Taken in large numbers near Moorhead City on sponge, in June.

*Proceræa rubropunctata* Langerhaus.

LANGERHAUS. Die Wurmfauna von Madeira. > Zeit. f. wiss. Zoöl., vol. 23, pp. 579, 580, Pl. xxxii, Fig. 30.

This species also occurs in abundance.

## Family NEREIDÆ.

**NEREIS** Cuvier.**Nereis limbata** Ehlers.

EHLERS. Die Borstenwürmer, pp. 567-570.

VERRILL. Invert. An. Vineyard Id., pp. 318, 590, Pl. xi, Fig. 51; New England Annelida, part 1, Pl. v, Fig. 3, 3a; Note on Nat. Hist. of Ft. Macon (Cooce and Yarow), No. 5. > Proc. Acad. Nat. Sci. Phil., 1878, pp. 299, 300.

WEBSTER. Annel. Chæt. Virginian Coast, pp. 35, 36, Pl. vi, Figs. 70-75; Annel. Chæt., Provincetown, p. 718.

Nonsexual forms are abundant in dredging material and also under stones along the shore, where a large atoke form occurs apparently sexually mature. Heteronereis forms of both sexes were found swimming at the surface in September. In aquaria they soon died, but many of them first deposited large quantities of spermatozoa and eggs. The eggs were then fertilized and soon underwent an unequal cleavage. Schackelford Bank, Green Rock, Horse Island, etc.

**Nereis irritabilis** Webster.

WEBSTER. Annel. Chæt. of Virginian Coast, pp. 31-34, Pl. v, Figs. 56-64; Pl. vi, Figs. 65-69.

Nonsexual forms were found in mud at Crab Point and Shark Shoal while epitoke female forms were taken in the tow net.

**Nereis pelagica** L.

MALMGREN. Annulata Polychæta, pp. 164-165, Pl. vi, Fig. 35.

EHLERS. Die Borstenwürmer, pp. 511-517, Pl. xx, Figs. 11-20.

VERRILL. Invert. An. of Vineyard Id., pp. 319-591, Pl. xi, Figs. 52-55.

WEBSTER. Annel. Chæt. Provincetown, p. 718.

Numerous small individuals collected near Moorhead.

**Nereis megalops** Verrill.

*Nereis alacris* VERRILL. Proc. U. S. Nat. Mus., vol. 11, 1879, p. 171.

*Nectonereis megalops* VERRILL. Invert. An. Vineyard Id., pp. 298, 592, Pl. 12, Figs. 62, 63.

*Nereis megalops* VERRILL. New England Annelida, part 1, p. 320.

The epitoke form originally described by Professor Verrill as *Nectonereis megalops* was taken at the surface on several occasions, while asexual forms and intermediate forms were found among Hydroids on the piles of Moorhead Wharf.

## Family EUNICIDÆ.

**EUNICE** Cuvier.**Eunice ornata**, sp. nov.

(Plate XIII, Figs. 6-13.)

Head distinctly bilobed, each part divided in front by a transverse groove into an upper smaller and a lower much larger area. Body rounded above, flat below, tapering gradually towards posterior end.

Buccal somite as long as following three somites, ventral swelling posterior to mouth conspicuous. Antennæ jointed, almost moniliform; median one longest, reaching almost to fourth setigerous somite; tentacular cirri half as long as buccal somite, jointed; anal cirri jointed, twice as long as tentacular cirri. Branchiæ pectinate, beginning on fifth setigerous somite as a simple filament, rapidly increasing and meeting in an arch over the back with as many as twenty posterior branches; decreasing less rapidly, small and with few branches from about the thirtieth somite to the end of the body. Parapodia not prominent; dorsal cirrus long; ventral cirrus shorter, with swollen base; setæ light colored, dorsal ones acute, flattened; ventral ones with a triangular tooth below the curved apex of outer joint; the *gauge-shaped* setæ have the terminal teeth prolonged. Jaws light with dark borders; supports rounded; pinchers blunt; dental plates with eight teeth on right and five on left; unpaired plate on left side with eight teeth; posterior pair of paragnaths with each nine teeth; anterior pair smooth, dark; outer pair square, with one tooth. General color golden reddish; white spot on median line of each setigerous somite; antennæ, tentacular cirri, and anal cirri white with red rings or transverse streaks. Eyes blue between outer and middle antennæ. Length up to 9 centimetres; diameter, 5 millimetres. Swims actively with spiral motion.

Not uncommon on sponges, etc., in 2 to 3 fathoms in sheltered sounds. The young were also found cast up on the Fort beach, after storms, upon seaweeds.

This species appears to be closely related to *E. articulata* Ehlers.

**DIOPATRA** Aud. and Edw.

*Diopatra cuprea* Aud. et Edw.

BOSC (*Nereis cuprea*). Hist. Nat. des Vers., vol. 1, 2d ed., pp. 163-165, Pl. XII, Figs. 1-4.

QUATREFAGES (*Eunice cuprea*). Hist. Nat. des Annélés, vol. 1, p. 331.

CLAPARÈDE (*D. neapolitana*). Annél. Chæt. Golfe de Naples, pp. 122-127, Pl. VI, Fig. 4.

VERRILL. Invert. An. Vineyard Id., pp. 346-593, Pl. XIII, Figs. 67, 68.

VERRILL. Notes on Nat. Hist. of Ft. Macon (Coues and Yarrow), Proc. Acad. Nat. Sci., Phil., 1878, p. 299, 300.

WEBSTER. Annel. Chæt., Provincetown, p. 270.

WEBSTER. Annel. Chæt. Virginian Coast, p. 63.

EHLERS (*D. fragilis*). Die Neubildung des Kopfes bei polychæten Anneliden. Erlangen, 1869.

This widely distributed Annelid, so common upon the northern coast of the Eastern States, was first found at Charleston by Bosc, and later at Beaufort, North Carolina, by Coues and Yarrow. From the description given by Ehlers of the specimens he received from Charleston and among which he found and studied a case of regeneration of the head and anterior somites it seems undoubtedly true that he had specimens of Bosc's *Nereis cuprea*, though he gives the new name *Diopatra fragilis*.

Among specimens taken at Beaufort is one that has reproduced a new head and several somites, just as in the case described by Ehlers. Moreover, sections show that the histological changes concerned are much as Ehlers found them. Study of this same species on the Massachusetts coast shows that this reproduction of anterior or of posterior end is a common occurrence and one of evident utility, almost a necessity, considering the habit of the animal. Its tubes are raised above the sand some inches and covered over with foreign objects, often quite long pieces of eel grass. To collect this, the creature's anterior end is protruded some distance from the protecting tube and must be a tempting morsel for fish, etc. At all events it is often cut off by some means. This is the more likely to occur since the eyes appear to be absent in this species and danger thus can not be so well avoided. After artificial removal of the head recrescence takes place inside the tube, in aquaria, with little lapse of time.

The young are sometimes taken in the tow net in July, the larger ones, 8 millimetres long, probably floating upon seaweeds, etc.

The adult is common upon the quieter, more muddy parts of Bird Shoal and near Crab Point, etc., between tides.

*Diopatra magna*, sp. nov.

(Plate xiv, Figs. 14-20.)

Body flat, elongated; first five or six somites, convex dorsally and turned upward so that the mouth is terminal; buccal somite small, widened at sides, as narrow above as first setigerous somite, bearing at middle of each side a smooth tentacular cirrus as long as first two setigerous somites. Head withdrawn into buccal somite; palps large, globose, with nodules anteriorly; antennæ smooth, with short annulated bases about as long as first setigerous somite; median antennæ and middle ones four times length of tentacular cirri, outer one about half the length of the median; tentacles cylindrical, with conical tips as long as bases of antennæ. Anterior five parapodia very stout, three upper ones directed forward. Branchiæ pectinate, beginning on the sixth setigerous somite as simple filaments. The number of their pinnules has increased to about twelve on the thirtieth segment, where the branchiæ meet on the back. Behind the middle of the body the pinnules of the branchiæ decrease gradually in number, the branchiæ becoming flabellate, bifid, and finally simply filiform on the posterior somites. Setæ in first five parapodia about thirteen to each, imperfectly jointed, with the hooked tips and tooth below them inclosed in a delicate hood; other parapodia bear about thirty simple pointed setæ, two stout hooked setæ, and delicate, asymmetrical, finely serrated chisel-shaped setæ. Jaw pieces dark; lower jaws with whitish tips indented on the edge; dental plates with eight teeth on right and seven on left; large pair of paragnaths with eight teeth on right and six on left; unpaired piece on left with eight teeth; two small pairs of paragnaths,

the one smooth, the other with a rounded boss. Color dark, except anterior end, which is flesh color with sprinkling of dark dots; branchiæ, dark brown; antennæ, reddish brown; body, translucent posteriorly; anus, very large; anal cirri, shorter and more slender than median antennæ. Length up to 1 meter; breadth, without parapodia, 16 millimetres; median antenna, 10 millimetres.

This species is more common than the preceding on the outer part of Bird Shoal at low-tide mark and below, constructing stout tubes which project several inches above the sand, and are covered with bits of shells, etc., and inclined to one side near the end. Young individuals, 1 centimetre long, are sometimes found in small tubes attached to the side of the large tubes—one of the few stable objects on these sand flats.

This is one of the largest Annelids of our coasts, full-grown specimens measuring upwards of 4 feet when freshly dug out of their correspondingly long vertical tubes. As they readily retire into the lower part of the tube and are easily broken into pieces in attempting to remove them, few perfect specimens can be obtained; but when the tide is rising over the tube, it is found that the animal is apt to be near the orifice and can, moreover, be more readily dug out uninjured when the tube remains under water.

The color is noticeably dark, only the anterior 3 or 4 inches being flesh color with blackish, minute spots. Posterior to about the first 7 inches the color is dark greenish brown, with translucent yellowish sides where contents of intestine do not give an opaque appearance. Branchiæ dark red-brown.

This species is readily recognized at a glance as differing from *D. cuprea* in the character of the branchiæ. It is probably this species also, and not *D. cuprea*, which produces the remarkably elongated, cylindrical masses of jelly found on the sand flats, drifted about by the tides. Each mass contains innumerable larvæ, the eggs having developed before July.

These larvæ have been figured and described by Prof. E. B. Wilson. (Studies Johns Hopkins University, vol. 2).

Both this species and the preceding are found to present peculiar strings of ovarian cells attached to the ova, both when projecting from the ovary and when floating free in the body cavity. A description of these is shortly to appear in the Journal of Morphology.

#### MARPHYSA Quatrefages.

##### *Marphysa sanguinea* Quatrefages.

*Eunice sanguinea* GRUBE. Fam. des Annél., pp. 44, 123.

LEIDY. Journ. Acad. Nat. Sci. Phil., 2d ser., part 2, vol. 3, p. 147.

*Marphysa leidyi* QUATREFAGES. Hist. Nat. des Annélès, vol. 1, p. 337.

*Marphysa leidyi* VERRILL. Invert. An. Vineyard Id., pp. 319, 593, Pl. XII, Fig. 64.

*Marphysa sanguinea* QUATREFAGES. Hist. Nat. des Annélès, vol. 1, p. 332, Pl. X, Fig. 5.

*Marphysa sanguinea* EHLERS. Die Borstenwürmer, p. 360, Pl. XVI, Figs. 8-11.

*Marphysa sanguinea* WEBSTER. Annel. Chæt. Virginian Coast, p. 36, Pl. VI, Figs.

76-80; Pl. VII, Figs. 81-83.



There seems to be great variability in the place of occurrence of the first branchiæ; some large specimens apparently belonging to this species have no branchiæ before the fortieth segment; in other cases the branchiæ begin much sooner upon one side than upon the other.

Large individuals are occasionally found in the sand on Bird Shoal, Crab Point, Green Rock, etc.

### **DRILONEREIS** (Clpd.) Webster.

#### ***Drilonereis longa*** Webster.

WEBSTER. Annel. Chæt. Virginian Coast, pp. 40-41, Pl. VII, Figs. 84-88; Annel. Chæt., Provincetown, p. 721.

Common in sand, Bird Shoal and various localities.

### **ARABELLA** (Grube) Ehlers.

#### ***Arabella opalina*** Verrill.

*Lumbriconereis opalina* VERRILL. Invert. An. Vineyard Id., pp. 342, 594, Pl. XIII, Figs. 69, 70.

*Arabella opalina* VERRILL. Check List of Mar. Invert. of Atlantic Coast, p. 8; Nat. Hist. of Ft. Macon (Cones and Yarrow); Proc. Acad. Nat. Sci. Phila., 1878, p. 399; New England Annelida, part 1, Pl. IV, Figs. 4, 4a.

*Arabella opalina* WEBSTER. Annel. Chæt. Virginian Coast, p. 42; Annel. Chæt., Provincetown, p. 721; Annelida from Bermuda, p. 321.

One of the most common forms met with in digging in muddy sand, occurring in great numbers in some of the quiet bays and creeks.

### **STAUROCEPHALUS** (Grube) Ehlers.

#### ***Staurocephalus sociabilis*** Webster.

Annel. Chæt. Virginian Coast, pp. 43, 44, Pl. VII, Figs. 89-91.

A few specimens were dredged near Green Rock in 1884, and again in 1885.

## Family GLYCERIDÆ.

### **EUGLYCERA** Verrill.

#### ***Euglycera dibranchiata*** Verrill.

*Glycera dibranchiata* EHLERS. Die Borstenwürmer, p. 670, Pl. XXIV, Figs. 1, 10-28.

*Rhynchobolus dibranchiatus* VERRILL. Invert. An. Vineyard Id., pp. 341, 596, Pl. X, Figs. 43, 44.

*Rhynchobolus dibranchiatus* WEBSTER. Annel. Chæt. Virginian Coast, p. 245; Annel. Chæt. Provincetown, p. 723.

*Euglycera dibranchiata* VERRILL. New England Annelida, part 1, p. 296.

Occurs everywhere on the various shoals, with the following species, but perhaps less commonly than the latter.

**RYNCHOBOLUS** Clpd.**Rhynchobolus americanus** Verrill.

*Glycera americana* LEIDY. Mar. Invert. Fauna of Rhode Island and New Jersey.

>Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 3, part 2, p. 147.

*Glycera americana* EHLERS. Die Borstenwürmer, pp. 668-670, Pl. xxiii, Figs. 42-43.

*Rhynchobolus americanus* VERRILL. Invert. An. Vineyard Id., pp. 342, 596, Pl. x, Figs. 45, 46; Notes on Nat. Hist. of Ft. Macon >Proc. Acad. Nat. Sci. Phila., 1878, pp. 299, 300.

*Rhynchobolus americanus* WEBSTER. Annel. Chæt. Virginian Coast, p. 45.

Very abundant on various shoals in the harbor.

Family **OPHELIIDÆ**.**OPHELINA** (Oersted) Grube.

*Ophelina agilis*, sp. nov.

(Plate xv, Figs. 21-26, 28.)

Body cylindrical, smooth; preoral lobe conical, acute, long as first four setigerous somites; anal tube cylindrical, slightly larger at end than at base, length equal to about eight of the preceding setigerous somites, truncated end produced into twenty to thirty slender subequal papillæ and with a median ventral, annulated cirrus projecting from its orifice about half the length of the entire tube. Setigerous somites fifty, all except the first bearing long, tapering branchiæ dorsal to the setæ, which are expanded at the base into an anterior crest or lamella, gradually disappearing towards the apex. Setæ more than half the length of the branchiæ, acute and flattened. First setigerous somite (opposite the mouth) bears a slender cirrus about half as long as the branchia of the following somite; upon the following somite this cirrus gradually decreases in length. Proboscis thick, tongue-shaped. Length, 30 millimetres; width, 1.5 millimetres; anal tube, 1.5 millimetres; branchiæ, 1 millimetre; breadth of sole, .75 millimetres.

Common in the sand of "Spatangoid" Shoal and dredged in channel north of Lewis, Thoroughfare.

Family **TELETHUSIDÆ**.**ARENICOLA** Lamarck.

*Arenicola cristata* Stimpson.

STIMPSON. On some remarkable marine invertebrates inhabiting the shores of South Carolina. >Proc. Bost. Soc. Nat. Hist., vol. 5, p. 114, 1856.

WEBSTER. Annelida from Bermuda. >Bull. U. S. Nat. Mus., No. 25.

QUATREFAGES. Histoire Nat. des Anneles, vol. 2, p. 673.

This, like the other species Stimpson found at Charleston (*Acetes lupina*), is a very large Annelid, occurring in the greatest abundance in the sand of Bird Shoal, Shark Shoal, etc., and excessively numerous in the muddy creek near Fort Macon.

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The immense jelly masses, in which the somewhat salmon-colored eggs are laid, protrude from the burrows of the Annelids, and subsequently are washed about from place to place as the larvæ develops.

The number of eggs thus laid by one individual was estimated as three hundred thousand.

Their development has been noted by Professor Wilson in the paper previously referred to.

The colors when alive vary, but in general the body is greenish yellow; the branchiæ dark red; the setæ yellow, though sometimes nearly black anteriorly.

When expanded the animal measures at least 12 inches, with a diameter of above one-half an inch.

The head is very small, dark flesh color, and may be entirely retracted and concealed.

### Family CHÆTOPTERIDÆ.

#### CHÆTOPTERUS Cuvier.

##### *Chætopterus pergamentaceus* Cuvier.

AUDOUIN AND MILNE EDWARDS. Classification des Annélides. >Ann. Des. Sci. Nat., ser. 1, vol. 30, p. 417, Pl. XXII, Figs. 1-4.

This remarkable Annelid is known to occur upon the New England coast also, being in part figured, with the larvæ also, by Professor Verrill in the Trans. Conn. Acad., vol. 4, Pl. XVII, and elsewhere described as occurring near Woods Holl, Mass. The development has been studied at Beaufort by Professor Wilson. Artificial fertilization is easily effected, and the habits of the adult well studied when kept in aquaria, each inside a glass tube of proper diameter. They then build out the ends by funnels of secreted parchment-like material. Left out of tubes the animal soon dies, becoming emaciated, with great loss of mucus.

The body is brilliantly phosphorescent, and this is easily seen to be due, as has been observed in Europe, to the presence of phosphorescent granules or minute bodies in the mucus secreted by the epidermis; this material shining brightly some time after its removal from the body, and hence not directly dependent upon nervous action.

The individuals I have since observed at Woods Holl, Massachusetts, however, do not exhibit any phosphorescence at all.

The peculiar chimney-like, upright ends of the U-shaped tube of this Annelid are rather easily found by looking over the flats, from a horizontal position, by proper illumination; but are found only in certain restricted areas, where the sand is mingled with mud and somewhat overgrown with eel-grass. In such areas on Bird Shoal and Shark Shoal, at extreme low-water mark, colonies of numerous individuals are found.

In these tubes occur the commensal crabs, *Porcellana* and *Pinnixa*, in

a surprising number of cases, considering the apparent difficulty of accounting for their presence, in pairs also, inside tubes they can not escape from.

Thus in ten tubes examined were found three pairs of *Porcellana* and four pairs of *Pinnixa*, besides a small *Pinnixa* and two very small crabs. In all cases one male and one female inhabit a single tube, though perhaps one tube was found with only a single male. The breeding season of *Chætopterus* seems to extend over the entire summer; even on September 20 eggs were discharged from the dorsally placed nephridial openings of a female kept in the aquarium. This discharge of eggs may often be readily brought about by adding a fresh supply of sea water to replace that the animal lives in. Perhaps there is a tendency to discharge eggs at the time of rising tide.

### Family SPIONIDÆ.

**NERINE** Johnston.

*Nerine agilis* Verrill.

VERRILL. Invert. An. Vineyard Id., p. 346, 600.

Very abundant in the sand on the outer beaches and at Fort Macon, perforating it with very numerous slender vertical holes. Often washed out by the waves they quickly burrow again into the sand, if not captured by birds.

**POLYDORA** Bosc.

*Polydora cæca* Webster.

Annel. Chæt. Virginian Coast, p. 52, Pl. IX, Figs. 119-122.

This Annelid is quite common, perforating dead shells.

*Polydora commensalis*, sp. nov.

(Plate XIV, Fig. 27.)

Body flat ventrally, somewhat convex dorsally, flattened posteriorly and rapidly tapering. Tentacular cirri in contracted state equaling diameter of body, flattened, with ciliated ventral groove. Cephalic lobe small, simple, rounded in front; lateral lobes rounded; eyes black, posterior pair smaller and nearer together. Both cephalic lobe and buccal somite usually retracted within first setigerous segment in preserved specimens. First four setigerous somites bear a dorsal and a ventral cylindrical cirrus or papilla shorter than diameter of tentacular cirrus, and with a fascicle of slender setæ at the base of each. Fifth somite, with a decreasing series of six stout, amber-colored setæ bent at tips, and with a thin lamelliform expansion on the concave side. Close to the base of these arises a small fascicle of short, delicate setæ, similar to those of the preceding somites.

Branchiæ begin upon the sixth setigerous somite, rapidly increase in length, equal half the diameter of the body and persist throughout,

though rudimentary on a few terminal somites. Anus dorsal, surrounded by an oval series of papillæ; posteriorly a pair of very small ones, next a much larger one on each side, and then five subequal and intermediate ones on each side—fourteen in all. Setæ of dorsal rami long, slender; those of first four somites more delicate and hair-like; setæ of ventral rami similar, but shorter, till twelfth segment is reached, where hooked setæ with lamella at tip appear, and gradually supplant all but one or two of the capillary setæ. Length, 25 millimetres; diameter, 1 millimetre. Color light; intestine dark; blood vessels conspicuous, translucent posteriorly. Number of somites, one hundred.

This interesting form was found in 50 per cent. of all the *Ilyanassa* shells inhabited by the small hermit crab *Eupagurus longicarpus* Stimps. and grown over by colonies of *Hydractinia*. It inhabits an imperfect calcareous tube built in the terminal spires of the shell, and a tunnel perforated through the columella to open externally just within the aperture of the shell. From this aperture the anterior part of the body is often extended. But one individual usually occurs in each shell; sometimes a second smaller one was found in the spire, whether an adult male or a young individual was not determined.

The eggs and larvæ in various stages are found within the Annelid's burrow in August, as described in a recent number of the *American Naturalist*.

### Family ARICIIDÆ.

#### ARICIA (Sav.) And. and Edw.

##### *Aricia ornata* Verrill.

VERRILL. Invert. An. Vineyard Id., p. 596.

WEBSTER. Annel. Chæt., Provincetown, p. 724.

Found near Crab Point in mud.

##### *Aricia rubra* Webster.

Annel. Chæt. Virginian Coast, pp. 53-55, Pl. IX, Figs. 23, 26.

Found in mud flats near the laboratory more abundantly than preceding form in 1884 and 1885.

#### SCOLOPLOS Ersted.

##### *Scoloplos robustus* Verrill.

*Anthostoma robustum* VERRILL. Invert. An. Vineyard Id., pp. 343, 597, 598, Pl. XIV, Fig. 76. Note on Nat. Hist. of Fort Macon (Cones and Yarrow), No. 5. > Proc. Acad. Nat. Sci. Phila., 1878, pp. 299, 300.

*Anthostoma robustum* WEBSTER. Annel. Chæt. Virginian Coast, p. 58.

*Scoloplos robustus* VERRILL. New England Annelida, Pt. I, p. 287.

*Scoloplos robustus* WEBSTER. Annel. Chæt., Provincetown, p. 724.

Many were dug from muddy sand.

***Scoloplos fragilis* Verrill.**

*Anthostoma fragile* VERRILL. Invert. An. Vineyard Id., pp. 344, 598, 599.

*Anthostoma fragile* WEBSTER. Annel. Chæt. Virginian Coast, p. 58.

*Scoloplos fragilis* VERRILL. New England Annelida, Pt. I, p. 287.

*Scoloplos fragilis* WEBSTER. Annel. Chæt., Provincetown, p. 724.

Less abundant than preceding species.

**Family CAPITELLIDÆ.****NOTOMASTUS Sars.*****Notomastus latericius* Sars.**

SARS. Fauna littoralis Norvegiæ, part 2, p. 9-12, Pl. II, Figs. 8-17.

QUATREFAGES. Hist. nat. des Annelés, vol. 2, p. 258.

HORST. Anneliden der Fahrten des "Willem Barents," > Nederland. Archiv. f. Zoöl., Sup. I, p. 20.

VERRILL. Brief contributions from Mus. of Yale College, No. 23, > Amer. Jour. Sci. Art., vol. 5; p. 101.

LANGERHANS. Die Wurmfauna von Madeira, IV, > Zeitt. f. wiss. Zoöl., vol. 40, pp. 259, 260.

The Beaufort specimens referred to this species are 4 centimetres in length and about 1 millimetre in diameter, and appear to belong to this rather than to any other described form, though the tori are less marked than in the figure given by Sars. Found in muddy sand, Shark Shoal and Crab Point.

**DASYBRANCHUS Grube.*****Dasybranchus caducus* Grube.**

*Dasybranchus caducus* GRUBE. Beschreibung neuer oder wenig bekannter Anneliden. > Archiv. f. Naturgesch., 1846, p. 161, Pl. v, Figs. 3, 4.

*Dasybranchus caducus* GRUBE. Fam. d. Anneliden, p. 76.

*Dasybranchus caducus* QUATREFAGES. Hist. nat. des Annelés, vol. 2, p. 258, 640.

The specimens referred to this species agree essentially with Grube's description of *D. caducus*. There are thirteen somites bearing capillary setæ and ramose branchiæ on many of the somites of the posterior region, but not apparently upon the more muscular anterior somites of that region, though in alcoholic specimens the branchiæ are often contracted or absent in part. Grube describes two species of *Dasybranchus* with no branchiæ and separates this genus from *Notomastus* merely by the number of somites in the anterior region (*Annulata semperiana*). As the last two somites of the anterior region belong in general appearance to the posterior region rather than to the anterior, the character of the setæ alone remains as a distinguishing mark, which seems scarcely of generic importance here.

This Annelid is found with the preceding, and more commonly than it.

## Family MALDANIDÆ.

**MALDANE** (Grube) Malmgren.**Maldane elongata** Verrill.

VERRILL. Invert. An. Vineyard Id., pp. 343, 609.

WEBSTER. Annel. Chæt. Virginian Coast, p. 259.

Found in mud at Crab Point and Shark Shoal. A fragment belonging, perhaps, to this genus was peculiar in having the dorsal surface of several somites thickly set with slender papillæ.

**CLYMENELLA** Verrill.**Clymenella torquata** Verrill.

*Clymene torquatus* LEIDY. Mar. Invert. Fauna of Rhode Island and New Jersey.  
> Journ. Acad. Nat. Sci. Phila., 2d ser., vol. 3, p. 146.

*Clymenella torquata* VERRILL. Invert. An. Vineyard Id., pp. 343, 608, Pl. xiv, Figs. 71-73.

*Clymenella torquata* WEBSTER. Annel. Chæt. Virginian Coast, p. 28. Annel. Chæt., Provincetown, p. 731.

Not uncommon on Bird Shoal and at Crab Point.

**AXIOTHEA** Malmgren.**Axiothea mucosa**, sp. nov.

(Plate xvi, Figs. 29-35.)

Body elongated, somites twenty-three, of which eighteen are setigerous, while the buccal, anal, and three preanal somites bear no setæ. First six or seven somites short, middle ones elongated, posterior ones again shortened, preanal one very short. Head as long as following somite, obliquely truncated; preoral lobe conical, elongated, slightly turned upward; inclined area bordered by a flange on each side, which rises rapidly in height from near the preoral lobe, then gradually becomes less in height and somewhat undulated, and meets its fellow posteriorly on the median line, with a slight notch between; inclosed area with a slight median ridge on its anterior two-thirds, on each side of which an elongated depression separates it from the flat area at the base of the flange; in front of the mouth a lyre-shaped collection of pigment spots following the edge of the preoral lobe. Anal somite short, bell-shaped, fringed by twenty to thirty tentacles, the ventral median one about as long as the bell, a few about half this length, with a group of three to four smaller ones between each adjacent two; anus terminal, on a papillated, extensible prominence, filling the upper part of the bell. Anterior edge of fourth somite a slight fleshy rim; cuticle smooth; dorsal and ventral surfaces of middle somite covered by whitish pads. Dorsal fascicles of about twenty setæ arising from a papilliform sheath, the pinnate ones very delicate; uncini with four well-marked teeth and a fifth smaller one, and as many as ten bristles under the

hook. About twelve uncini on first setigerous somite, increasing to thirty posteriorly; color greenish, often with red or yellow shades. Fourth to seventh somites often dark. Length up to 80 millimetres; diameter, 2 millimetres.

As defined by Malmgren, this genus should have four preanal somites without setæ, but Langerhans has already placed one form here with but two such somites, thinking that the number is not of as much constancy as Malmgren supposed. In all other respects this Beaufort species fits very well into Malmgren's genus.

This is one of the most abundant Annelids found at Beaufort; its sand tubes stand quite close together over large areas of Bird Shoal, projecting above the sand and often bearing a clear, gelatinous mass, cylindrical with rounded ends and about an inch long in which numerous eggs are inclosed. In these masses, exposed alternately to the air at low tide and to the water at high tide, the eggs develop and the young remain often till quite advanced. It is, I believe, this species the eggs of which have been in part the subject of Professor Wilson's paper on the segmentation of Annelids, though it was there referred to as *Clymenella torquata* (Johns Hopkins University Studies, vol. 2).

As these masses completely close the orifice of the tube the Annelid makes a new opening a few inches below the surface of the sand and thence builds up a second branch, forming thus a Y-shaped tube, one arm of which is closed at the end by the egg mass, while the other gives the Annelid access to the water.

#### PETALOPROCTUS Quatrefages.

(The species described below is referred to this genus as being probably closely related to the forms described by Quatrefages; yet it would be perhaps better to form a new genus for it.)

*Petaloproctus socialis*, sp. nov.

(Plate xvii, Figs. 36-41.)

Body elongated, composed of twenty-three somites, of which twenty-one are setigerous. Buccal somite twice the length of first setigerous somite; anal somite equal to buccal; second to fourth setigerous somites gradually increasing in length; fifth to seventeenth somites much longer; seventeenth to twenty-first decreasing rapidly; twenty-first an inch shorter than anal. Form of head varying much according to state of contraction; when expanded conical, flat below, rounded above, somewhat truncated above, ending in a crescentic rim or ridge bearing red pigment spots on the side, from which rim a median elevation runs back dorsally half the length of the head, separating a depression on the right from one on the left, while these in turn are divided by a slight elevation into an anterior and a posterior part. Mouth ventral near the anterior end of the head. Anal somite truncated dorsally and



bearing a broad, spreading lamella, which projects most at the ventral posterior part and is not prolonged anteriorly. Anus terminal somewhat below the axis of the body and the center of the area circumscribed by the flange or lamella. All except buccal and anal somites bear dorsally a fascicle of slender setæ; 4 to 5 long bilimbate ones, and a greater number of more hair-like slender ones; a few middle somites bear also a few very long undulating setæ, serrulate, with delicate lamellæ. The first three setigerous somites bear ventrally each a single stout, amber-colored spine, which is bluntly pointed, transversely striate below, and projects plainly beyond the cuticle.

The other setigerous somites bear a single row of uncini, about ten in the fourth setigerous somite and twenty in the posterior ones; each has five teeth and a single stout bristle crossing over the main tooth. Length up to 100 millimetres, diameter 3 millimetres. Color variable, brown, flesh-color, dark red; fourth to ninth somites often darker.

This Annelid constructs thick, coarse tubes of sand, often cemented together in groups and coiled and convoluted a few inches below the surface of the sand, forming thus firm clumps into which the Annelid retreats and from which entire individuals can be taken only with difficulty, as the body breaks with the tube. Parts at least of many individuals are thus protected from storms and other destructive agents. Many are found with newly-formed heads or posterior ends. This is a common form on the outer edge of Bird Shoal and is sometimes exposed at very low tides, living in sand mingled with shells or fragments.

### Family AMMOCHARIDÆ.

#### **AMMOCHARES** Grube.

*Ammochares ædificator*, sp. nov.

(Plate XIV, Figs. 42-45.)

Body cylindrical, smooth, tapering posteriorly, divided by bands of uncini into eighteen to twenty-one sections, the first-six very long, subequal, forming about two-thirds of the entire length, following sections rapidly becoming very short. Body terminates posteriorly, simply, conically with slit-like anus; anteriorly in crown of tentacles surrounded by a delicate membranous collar. The tentacles present five chief fleshy stems on each side, branch four times, generally dichotomously, and end in blunt lobules; dorsally they are separated by a median, slightly triangular lobe and ventrally by an interval. Mouth terminal with three fleshy lobes or lips, one dorsal, two lateral. First section of the body bears two fascicles of setæ on each side; the posterior one is near the middle of the section and contains about one hundred setæ; the anterior one is halfway between the posterior and the tentacles and contains fewer setæ. There is, moreover, a small fascicle of about twenty setæ nearer the dorsal line and quite near the posterior end of the section

which has apparently not been observed in other species of this genus. The dorsal fascicles above the bands of unncini contain about fifty setæ and are closely approximated dorsally on the anterior segments farther apart posteriorly. Bands of uncini nearly meet ventrally on the anterior segments and are there composed of twenty-five vertical rows of hooks. Each uncinus has two equal teeth. Length up to 50 millimetres; diameter, 3 millimetres. Color, light reddish; tentacles variously marked with white, red, and green.

It constructs elegant cylindrical tapering tubes often 15 centimetres long and 6 millimetres in diameter, which are covered with worn discolored fragments of shells, densely packed and generally set at an angle to the axis of the tube. The tubes stand buried in the sand.

These Annelids in their tubes are not uncommon in certain restricted shelly areas of Bird Shoal toward Fort Macon, where scarcely uncovered by the tide. The excrement is discharged as cylindrical masses half the length of the body, composed of excessively fine sand held together by mucus.

### Family HERMELLIDÆ.

#### **SABELLARIA** Lamarck.

##### **Sabellaria vulgaris** Verrill.

*Sabellaria vulgaris* VERRILL. Invert. An. Vineyard Sd., pp. 321, 611, Pl. xvii, Figs. 88, 88a; Notes on Nat. Hist. of Ft. Macon (Cones and Yarrow), >Proc. Acad. Nat. Sci. Phila., 1878, pp. 299, 300; New England Annelida, part 1, p. 318.

*Sabellaria varians* WEBSTER. Annel. Chæt. Virginian Coast, p. 59, Pl. ix, Figs. 133-137; Pl. x, Figs. 137-139.

This Annelid is common on shells, etc., in a few fathoms of water. The females are colored brilliant purplish by the mature eggs, and the smaller males dull white when distended with spermatozoa. The eggs are easily fertilized artificially, but develop with many individual irregularities and abnormalities. The cleavage is not like that figured recently by von Drasche for a European species of *Sabellaria*.

### Family AMPHICTENIDÆ.

#### **PECTINARIA** Lamarck.

##### **Pectinaria gouldii** Verrill.

*Cistenides gouldii* VERRILL. Invert. An. Vineyard Sd., pp. 323, 612, Pl. xvii, Figs. 87, 87a. Proc. Acad. Nat. Sci. Phila. (Cones and Yarrow), 1878, p. 300.

*Cistenides gouldii* WEBSTER. Annel. Chæt., Provincetown, p. 731.

*Pectinaria gouldii* VERRILL. New England Annelida, part 1, p. 237.

Found occasionally in the sand near low-water mark; Shark Shoal and Bird Shoal. The beautiful conical tubes appear to be placed, normally, with the apex near the surface of the sand, the large orifice and head of Annelid buried deeply, but do not stand vertically. Large eggs are found in the body cavity in August.

## Family TEREBELLIDÆ.

**AMPHITRITE** (Müller) Malmgren.**Amphitrite ornata** Verrill.

*Terebella ornata* LEIDY. Mar. Invert. Fauna. Rhode Island and New Jersey. > Jour.

Acad. Nat. Sci., 2 ser., vol. 3, p. 146, Pl. XI, Figs. 44, 45.

*Amphitrite ornata* VERRILL. Invert. An. Vineyard Id., pp. 320, 613, Pl. XVI, Fig. 82.

*Amphitrite ornata* WEBSTER. Annel. Chæt. Virginian Coast, p. 62; Annel. Chæt., Provincetown, p. 732.

The specimens examined differ considerably from the northern form in the shape of the uncini, to judge from the figures given by Leidy; but not knowing the degree of accuracy of these figures nor the limits of individual variation in these characters, I have referred the specimens to *A. ornata*. Common in soft mud near Orab Point; many small individuals occurred in mud tubes amongst hydroids, ascidians, etc., upon the bottom of an old scow anchored in deep water.

**LOIMIA** Malmgren.**Loimia turgida**, sp. nov.

(Plate XIV, Figs. 46-49.)

Body much swollen anteriorly, slender posteriorly, smooth dorsally, somites scarcely distinguishable. Tentacles longer than body in extension, in alcohol not reaching to sixteenth setigerous somite; much more slender than the stem of the branchiæ. Ventral shields nine, length about equal; breadth of the first about one half greater than that of the ninth; first one represents the ventral surface of the second, third, and fourth somites and is indistinctly divided into two. The elevated region formed by the shield is continued on the following six somites as a series of folds, three to four for each somite, decreasing in width in the same proportion as the shields. Lamella of the second to third somites large, oblong. Some of the uncini bear six teeth instead of five, the usual number. Anus surrounded by about ten blunt papillæ. Color greenish-white, tentacles crossed by about fifty bands of brown-red pigment. Length, 60 millimetres; diameter, 4 millimetres; tentacles, 12 millimetres; breadth of first shield, 3.7 millimetres; of ninth shield, 2.5 millimetres. Number of somites about ninety; setigerous somites seventeen.

The tentacles break off readily in alcohol, being attached by means of a small swollen area, below which is a similar but smaller process beyond the end of the ventral groove, so that the broken off tentacles have the appearance of being cleft or bilobed at the end. Found under stones along the shore.

**LEPRÆA** Malmgren.**Lepræa rubra** Verrill.

VERRILL. Invert. An. Vineyard Id., pp. 382, 615, 616.

WEBSTER. Annel. Chæt. Virginian Coast, p. 63.

Collected upon oyster shells near Horse Island.

**POLYCIRRUS** (Grube) Malmgren.**Polycirrus eximius** Verrill.

**VERRILL.** Invert. An. Vineyard Id., p. 616, 320, Pl. xvi, Fig. 85.

**WEBSTER.** Annel. Chæt. Virginian Coast, p. 63; Annel. Chæt. Provincetown, p. 735.

Dredged near Green Rock in 1884 and in 1885.

Family **SABELLIDÆ**.**SABELLA** (L) Malmgren.**Sabella microphthalma** Verrill.

**VERRILL.** Invert. An. Vineyard Id., pp. 323, 618; Nat. Hist. Ft. Macou (Cones and Yarrow). > Proc. Acad. Nat. Sci. Phila., 1878, pp. 299, 300.

**WEBSTER.** Annel. Chæt. Virginian Coast, p. 65; Annel. Chæt., Provincetown, p. 735.

Common amongst masses of sponge in shallow water near Moorhead City and Horse Island.

**PROTULIDES** Webster.**Protulides elegans** Webster.

Annelida from Bermuda. > U. S. Nat. Mus. Bull., No. 25, 1834, pp. 325, 326, Pl. xi, Figs. 63-74.

This Annelid is not uncommon on shells, etc., in a few fathoms of water in Bogue Sound. In coloration the specimens agree closely with those described by Professor Webster, which were also collected at Beaufort, but the occurrence of double rows of uncini upon the abdominal segments seems not to be constant.

Family **SERPULIDÆ**.**HYDROIDES** Gunnerus.**Hydroides dianthus** Verrill.

*Serpula dianthus* Verrill. Invert. An. Vineyard Id., p. 620.

*Hydroides dianthus* Verrill. Proc. Acad. Nat. Sci. Phila. (Cones and Yarrow), 1878, p. 300.

*Hydroides dianthus* Webster. Annel. Chæt. Virginian Coast, p. 266; Annelida from Bermuda, p. 327.

Young individuals were found on seaweed cast up on the beach, while the mature forms of both sexes are common upon shells, which have been brought up onto Bird Shoal by storms or are dredged in Bogue Sound, etc.

In the preceding list of fifty-seven species of Polychætæ found at Beaufort I have endeavored to avoid the making of new species, but have nevertheless found it necessary to describe the following ten as new: *Harmothoe aculeata*, *Eunice ornata*, *Diopatra magna*, *Ophelina agilis*, *Polydora commensalis*, *Axiotea mucosa*, *Petaloproctus socialis*, *Ammochares ædificator*, *Loimia turgida*. Of the other species the fol-

lowing four are new to America: *Syllis spongicola* Grube, *Proceras ornata* Mar. and Bob., *P. rubropunctata* Langerhans, *Dasybranchus caducus*.

Four genera are represented in the Beaufort fauna not previously known to occur in America: *Ophelina*, *Dasybranchus*, *Petaloproctus*, *Loimia*; while *Ammochares* is known only as mentioned in a list of Annelids dredged in the Gulf of Maine by Professor Verrill (Am. Jour. Arts and Sci., v. 7, 1874, p. 411) and is a member of a family, *Ammocharidæ*, not otherwise represented on the coast of the United States, as far as known; a fragment belonging to this genus was, however, found in Virginia. Of the twenty-four families represented, the *Syllidæ* have six, the *Eunicidæ* have seven species, while the *Maldanidæ* are represented by four; however, the forms living in sand are probably unduly emphasized in this collection, since the unusually large areas of sand flat nearly exposed at low tide furnished such advantages for collecting such species, especially in the warm waters of that coast, that other localities were less visited. From Ehler's monograph upon the *Blake* collection, and from a collection I have made at Green Turtle Cay, Bahamas, it would seem that the *Eunicidæ* is the most richly represented family along the warm coasts of the southern United States and neighboring islands.

Besides the adult Annelids given in the above list young and larval forms were taken in the tow net, often in great abundance. Among the most beautiful of these were immature specimens of *Tomopteris*, resembling *T. Rolasi* Greef, taken on several occasions in the inlet.

Young *Lepidonotus* with long provisional setæ were common, as were the larvæ of *Chaetopterus*. *Nereis*, as egg, larva and young, was abundant; the eggs and early larvæ being conspicuous as having large oil drops in the transparent floating cells surrounded by invisible jelly.

One of the most interesting and abundant forms in the tow net is the young of *Loimia turgida*. It floats about inside a gelatinous tube longer than the body and much thicker than those figured by Claparède as occurring about young *Terebella conchylega*. In such larvæ the otocysts are conspicuous, anterior to the first pair of setæ; the tentacles come in gradually in pairs, one each side of a longer median one; colored spots appear early upon the tentacles; the branchiæ appear from before, posteriorly, at first as simple tubercles; two large and numerous small pigment spots are present.

A young *Arenicola* was found in a similar gelatinous tube; here also large otocysts are present, one on each side, dorsally, in the anterior part of the buccal somite; each contains a single large otolith.

Young *Scoloplos*, *Euglycera dibranchiata* V., and many unknown larvæ, were taken. The Spionidæ were especially well represented in surface collections, several forms of *Polydora*, a *Nerine*, a *Prionospio* with pinnate branchiæ and tentacles, and the remarkable larvæ of *Magelona* almost identical with those figured and described by Clap-

parède (Beobachtungen, Normandie, 1863) as well as larvæ like those in Pl. VI, of the above-cited work, but having only smooth setæ except in certain older specimens.

A *Mitraria* was occasionally observed and reared to a stage having nine somites and a single row of uncini, numerous upon the middle somites. The shape of these uncini suggests what is found in the adult *Ammochares*, but though these Annelids were kept in aquaria for three months no fertilized eggs were obtained, and so the question is an open one as to the reference of *Mitraria* to *Ammochares*.

*Polygordius* larvæ, having red eye spots and a row of red and of yellow areas, occur at certain periods, somewhat abundantly.\*

#### EXPLANATION OF PLATES.

##### PLATE XII. *Harmothoe aculeata*, sp. nov.

- Fig. 1. Side and face view of ventral seta and side view of dorsal seta.
- Fig. 2. Part of posterior edge of one of larger elytra.
- Fig. 3. Parapodium.
- Fig. 4. Dorsal view of head and extended proboscis.
- Fig. 5. One of smallest elytra.

##### PLATE XIII. *Eunice ornata*, sp. nov.

- Fig. 6. Dorsal view of anterior end, from living specimen.
- Fig. 7. Jaws  $r^1$   $r^2$   $r^3$   $r^4$  on right side;  $l^1$   $l^2$   $l^3$   $l^4$  on left side; L, unpaired piece on left side; V, ventral pieces; D, main dorsal jaws.
- Fig. 8. Dorsal view of posterior end, living specimen.
- Fig. 9. Fourth parapodium on right side.
- Fig. 10. Four setæ from parapodium of forty-fifth somite.
- Fig. 11. Parapodium of forty-fifth somite.
- Fig. 12. Parapodium of seventeenth somite.
- Fig. 13. Blunt seta of ventral part of parapodium of forty-fifth somite.

##### PLATE XIV. *Diopatra magna*, sp. nov.

- Fig. 14. All jaw pieces; letters as in Fig. 7.
- Fig. 15. Parapodium of fourth somite, right side.
- Fig. 16. Right parapodium, posterior to two hundredth somite.
- Fig. 17. Right parapodium of seventeenth somite.
- Fig. 18. Posterior end, dorsal view.
- Fig. 19. Three setæ of anterior somite and tip of large seta from fortieth somite.
- Fig. 20. Side view of anterior end of body.

##### PLATE XV. *Ophelina agilis*, sp. nov., and *Polydora commensalis*, sp. nov.

- Fig. 21. Side view of entire animal; live specimen.
- Fig. 22. Side view of expanded branchial apparatus; A, anterior, and P, posterior.
- Fig. 23. Extended proboscis.
- Fig. 24. Dorsal view of anterior end, from living specimen.

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\* I may here add a list of a few Polychætæ collected at the mouth of the Chesapeake, at Lynnhaven, in April, 1888. *Nephtys bucera* Ehlers, *Euglycera dibranchiata* Verrill, *Scoloplos robustus* Verrill, *Scoloplos fragilis* Verrill, *Ophelia simplex* Leidy, *Hydroides dianthus* Verrill.

Fig. 25. Ventral view of posterior end, living specimen.

Fig. 26. Parapodium, with branchia.

Fig. 27. Large seta of fifth somite and common hook seta of *Polydora commensalis*.

Other figures published in the American Naturalist, 1891.

Fig. 28. Large and minute setæ of *Ophelina agilis*, sp. nov.

PLATE XVI. *Axiothea mucosa*, sp. nov.

Fig. 29. Entire animal, from living specimens.

Fig. 30. Side view of anterior end, from living specimens.

Fig. 31. Ventral view of anterior end, living specimens.

Fig. 32. Dorsal view of anterior end, living specimens.

Fig. 33. Posterior end, living specimen.

Fig. 34. Tube in sand, old orifice stopped by jelly mass containing eggs, new orifice at end of a side branch of tube.

Fig. 35. Four setæ.

PLATE XVII. *Petaloproctus socialis*, sp. nov.

Fig. 36. Entire animal, live specimen.

Fig. 37. Dorsal view of anterior end, live specimen.

Fig. 38. Posterior end, live specimen.

Fig. 39. Ventral view of anterior end.

Fig. 40. Tube in sand, showing coiled part beneath surface.

Fig. 41. Four setæ.

PLATE XVIII. *Ammochares ædificator*, sp. nov., and *Loimia turgida*, sp. nov.

Fig. 42. Entire animal; living specimen.

Fig. 43. Oral surface with expanded branchiæ, diagrammatically drawn from living specimens; D, dorsal; V, ventral.

Fig. 44. Seta and uncinus.

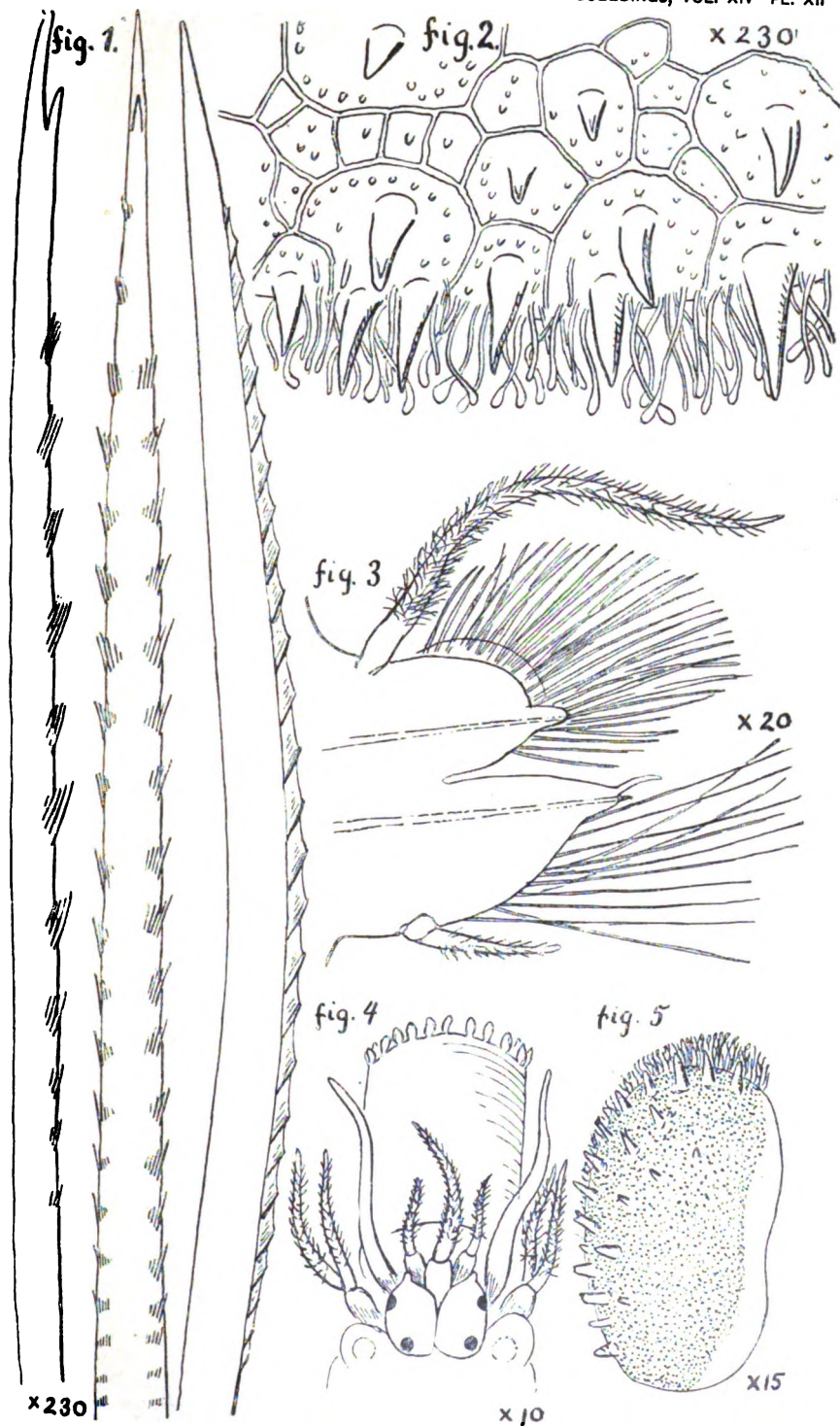
Fig. 45. Tube in sand, spindle-shaped near surface; of leathery consistence.

Fig. 46. Young *Loimia turgida* in floating, transparent tube.

Fig. 47. Base of tentacle of adult *L. turgida*.

Fig. 48. Setæ of adult *L. turgida*.

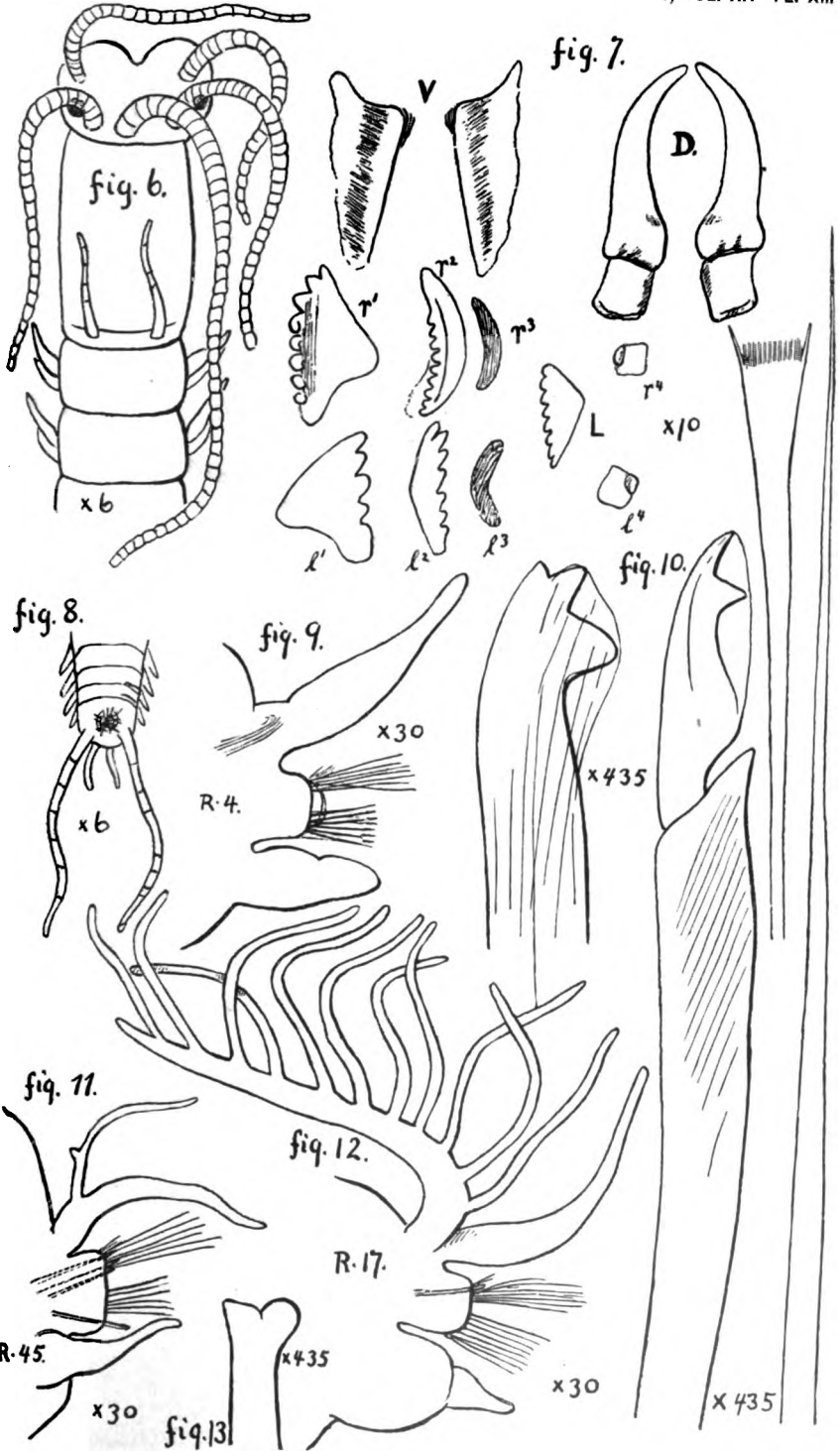
Fig. 49. Uncinus of adult *L. turgida*.



*HARMOTHÖE ACULEATA*, new species.

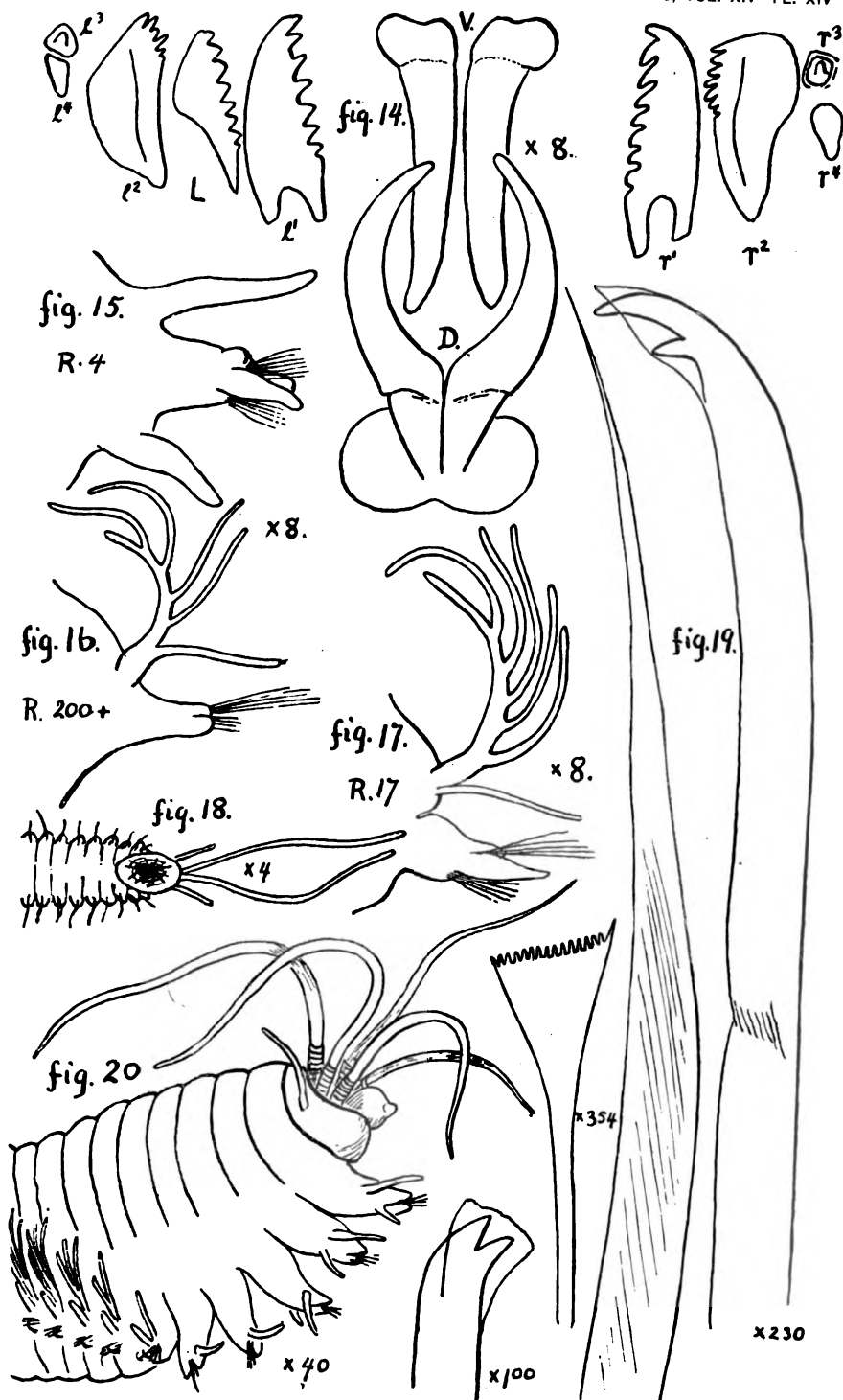






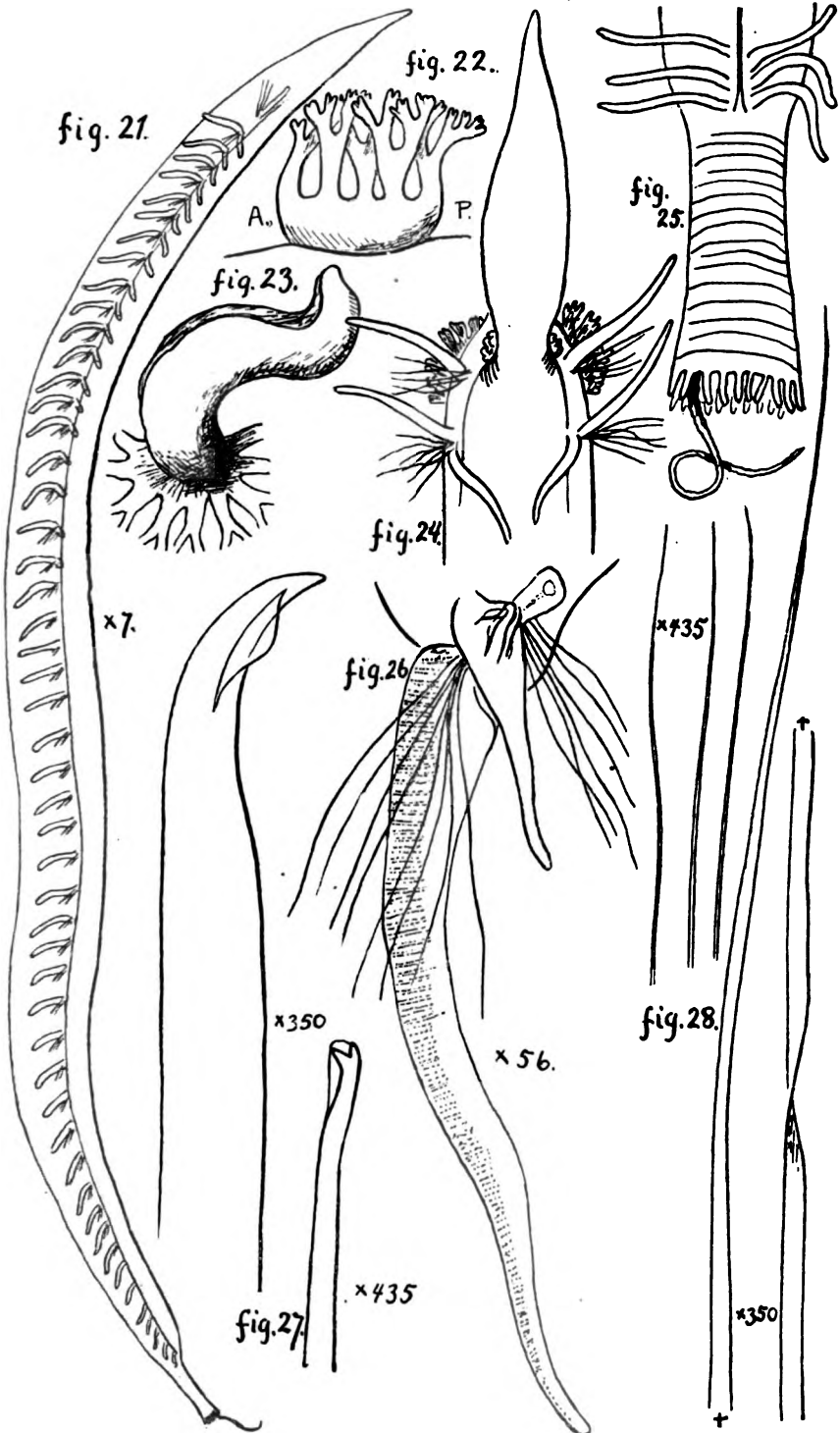
EUNICE ORNATA, new species.





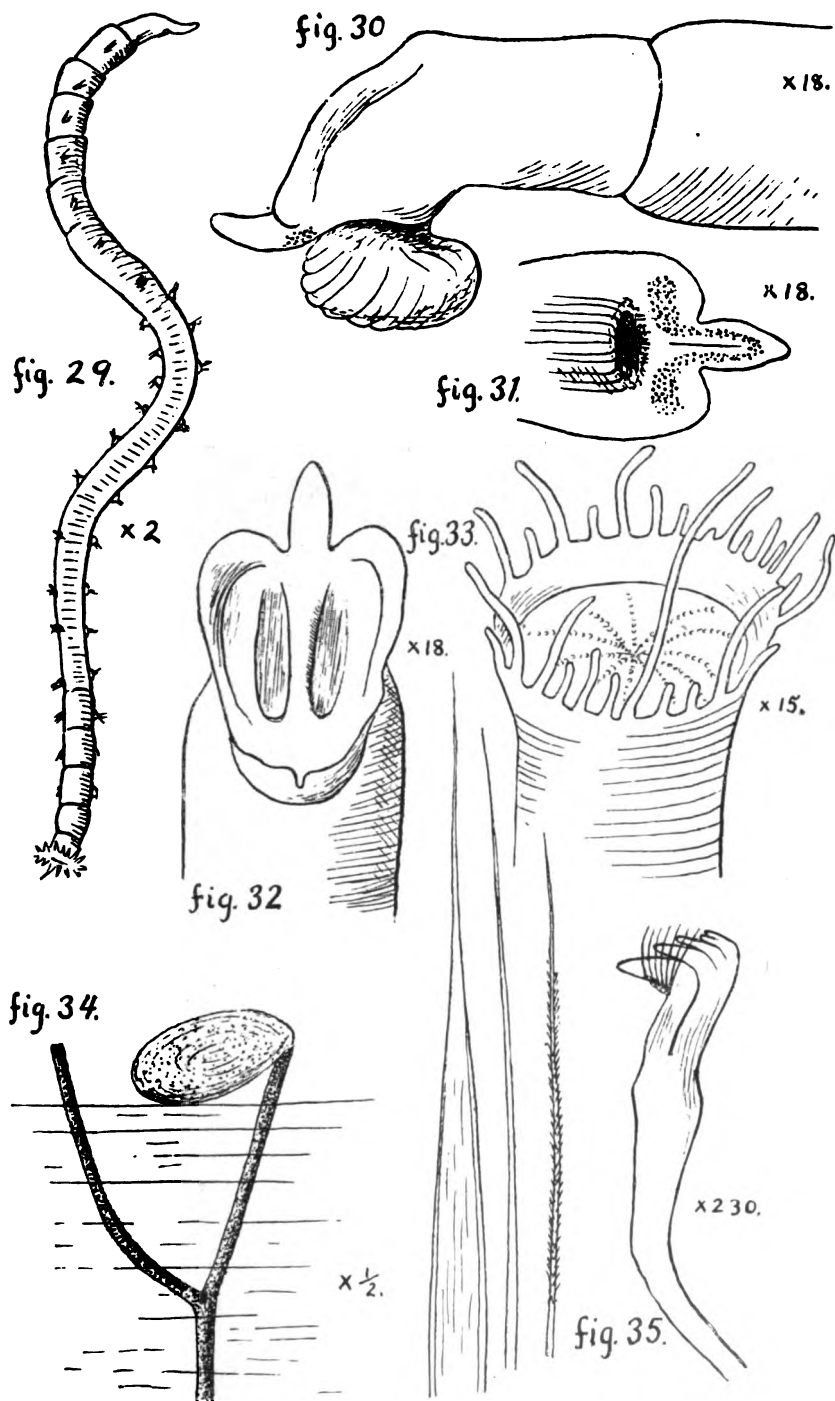
DIOPATRA MAGNA, new species.





OPHELELLA AGILIS and POLYDORA COMMENSALIS, new species.





AXIOTHEA MUCOSA, new species.





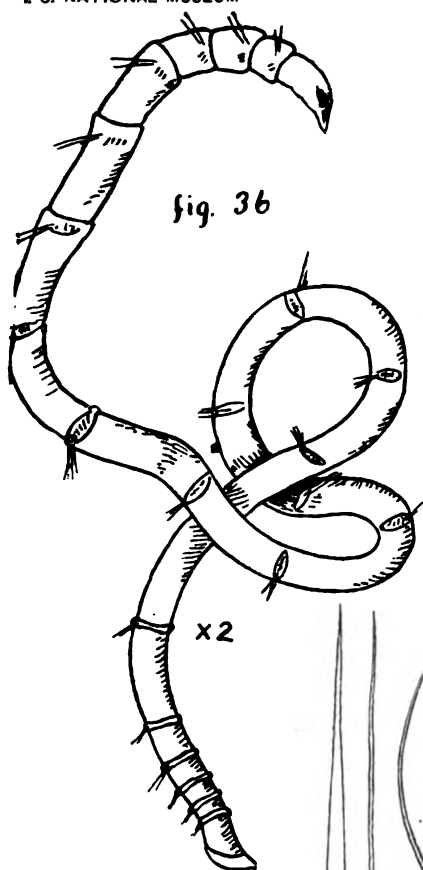


fig 37



fig. 38

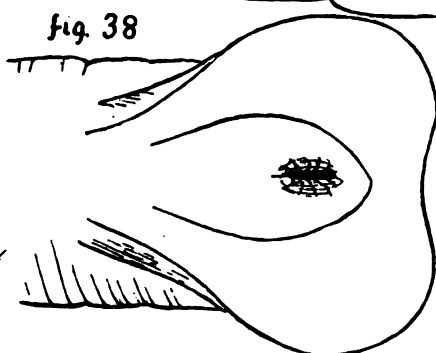
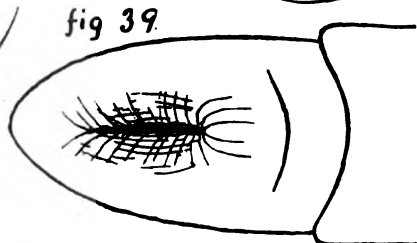


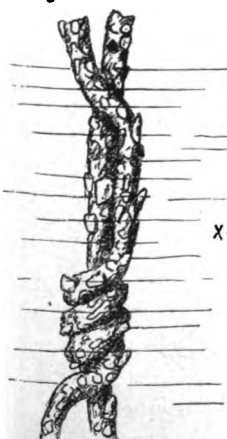
fig 39



x2

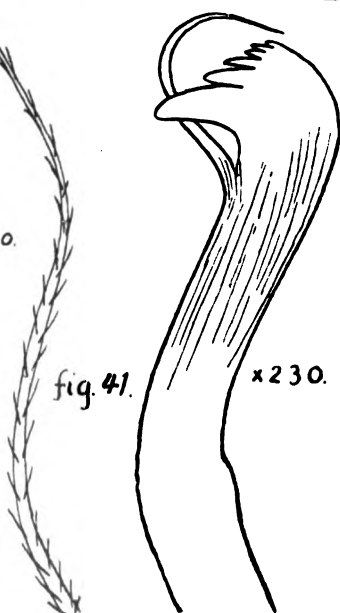
x230

fig. 40.



x  $\frac{1}{2}$

fig. 41.



x230



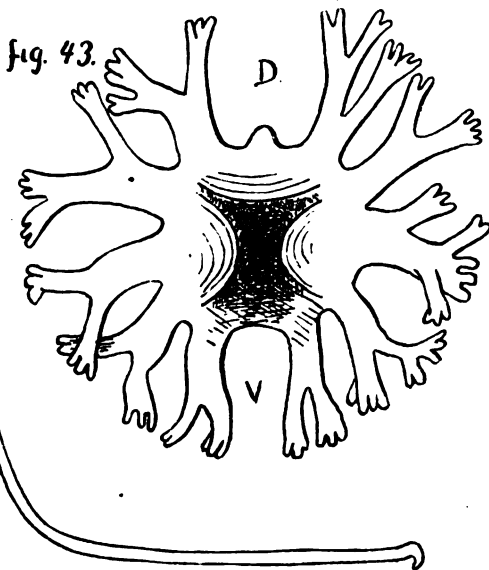
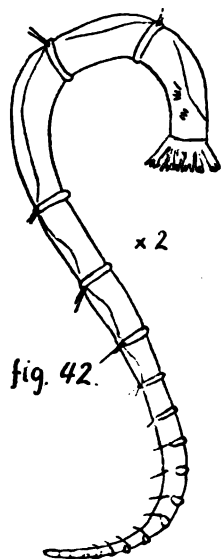
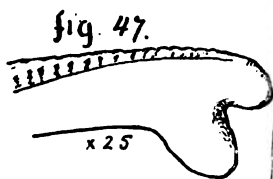
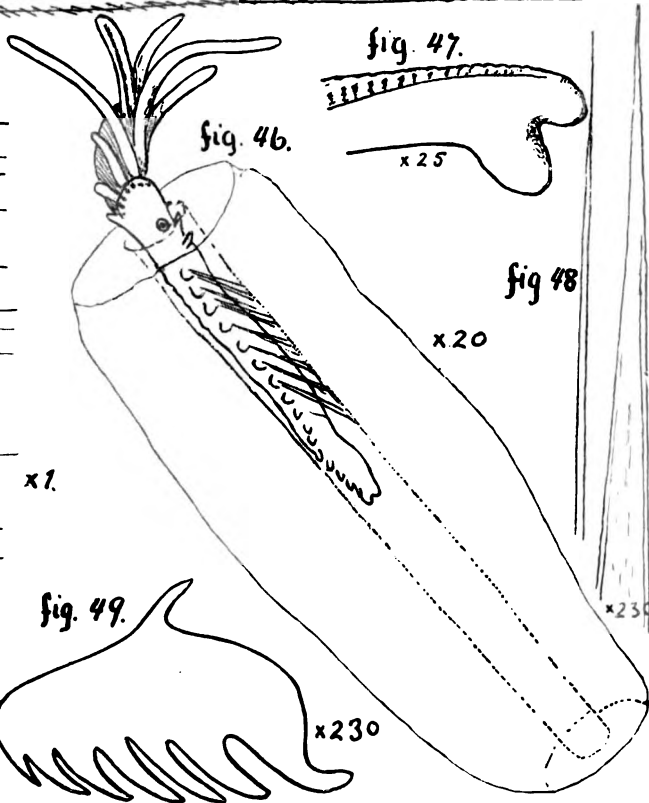
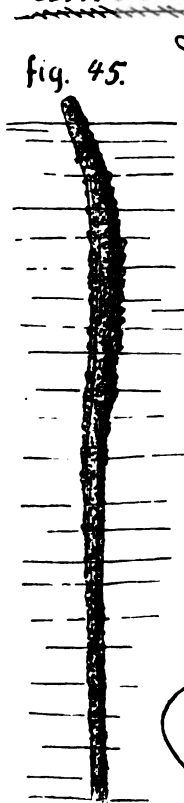


fig. 44. x435.



AMMOCHARES AEDIFICATOR and LOIMIA TURGIDA, new species.



ON ELEGINUS OF FISCHER, OTHERWISE CALLED TILESIA OR  
PLEUROGADUS.

BY  
THEODORE GILL, M. D., PH. D.

An Arctic type of the family of Gadids, to which the specific names *Gadus navaga*, *G. gracilis*, and *G. wachna* have been given, is distinguished by beam-like parapophyses of the abdominal vertebræ channeled below. This peculiarity, it was supposed, had been first made known by Dr. Bean. By American authors the name *Tilesia* (of Swainson) or subsequently *Pleurogadus* (given by Bean because *Tilesia* was preoccupied) has been used as a subgeneric or generic name. No one supposed that a previous name could have been given; but in looking through volumes of the "Mémoires de la Société Impériale des Naturalistes de Moscou," recently obtained to fill gaps in the series in the library of the Smithsonian Institution, I came across a memoir previously entirely unknown to me as well as to others. The memoir is entitled "Recherches zoologiques par G. Fischer," and is in the fourth volume (2d ed., pp. 237-275). The volume was originally published in 1812 and 1813, but a second edition was issued in 1830 (1812-1813. Réimprimés en 1830). The Researches comprised four chapters, viz: "I. Sur le Sym du Caucase" (p. 240); "II. Sur le Jeltopusick" (p. 241); "III. Sur le Navaga" (p. 252); "IV. Notices sur l'anatomie des poissons: A. Sur l'ouie des poissons" (p. 265) and "B. Sur une articulation propre aux poissons; articulation annulaire" (p. 272). The memoir was illustrated by eight plates (pl. 2-9), on four of which (pl. 5-8) were delineated structural details of the Navaga as well as a good figure of the entire fish, the best indeed that has been published.

Dr. Fischer, in the chapter on the Navaga (III. Sur le Navaga), designated that fish as the "*Eleginus navaga*, Fischer.—*Gadus navaga*, Pallas." He recalled that Pallas had recognized it as a distinct species but that Tilesius regarded it as a mere variety of the common Cod (*Gadus callarias*). He, however, not only considered it to be specifically distinct, but even generically different from *Gadus*.\* After

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\* Je tâcherai de démontrer que le Navaga est non seulement une espèce distincte, ce que Pallas a déjà prouvé, mais qu'il diffère même génériquement du genre *Gadus*. Fischer, o. c., p. 254.

enumerating the Cuvierian subdivisions of *Gadus Linn.*, he gave the characteristics of the new genus in the following terms : \*

Le genre *Eleginus*, (*ἔλεγινος*, d'Aristote, désignant des poissons qui vivent en société) auquel le *Navaga* de la mer blanc sert de type, a beaucoup de ressemblance avec la première section des Gades, ayant trois nageoires dorsales et deux anales, mais dont le barbillon est si petit qu'on a peine à l'apercevoir. La tête est forte, les mâchoires sont moins dentées, et le corps est plus arrondi que déprimé. La ligne latérale est complète et fait une grande courbe derrière l'anus. Le squelette offre une peculiarité qu'on ne trouve dans aucun autre poisson, c'est que les apophyses transversales des vertèbres du dos sont très allongées, et crenelées, et se terminent dans un petit corps obtusement conique et évasé de sorte que toute l'apophyse ressemble assez à la forme d'une pantoufle. Aussi les Allemands à Moscou, à cause de cette singulière conformation de son squelette, appellent-ils ce poisson *Pantoffelfisch*.

While mistaken in supposing that the possession of elongated hollowed transverse apophyses was entirely peculiar to the *Navaga*, Fischer's description was admirable for the time and quite pertinent to the genus. Strange that we have to go back to the early part of the century to a Russian† naturalist for definite information respecting a common North European fish!‡ Dr. Günther, in his great work (v. 4, p. 330), gave a brief diagnosis merely of the external features of the *Navaga* immediately after his diagnosis of the common Cod (*Gadus morrhua*), and no reason was therein given for supposing it was notably distinct from the latter species. Its vertebræ were noticed simply as "Vert. 58," thus contrasting with the "Vert. 19-32" of the Cod, nothing being said of the structure of either.

It therefore now appears that the name *Eleginus* must be revived as the generic designation of the arctic Gadid variously named *G. navaga*, *G. gracilis* and *G. wachna*.

### ELEGINUS.

#### Synonymy.

*Eleginus* G. Fischer, Mém. Soc. Nat. Moscou, v. 4, (2d ed., p. 252-257), 1813.

*Tilesia* Swainson, Nat. Hist. Fishes, etc., v. 2, p. 300, 1839 (not *Tilesia* Lam., 1821).

*Pleurogadus* Bean with Jordan, Cat. Fishes N. Am., p. 130, 1885.

#### ONLY SPECIES.

*Eleginus navaga* (Kölreuter, 1770) G. Fischer = *Gadus gracilis* Tilesius § = *Gadus wachna* Pallas.

HABITAT: Northern Russia, Bering Sea. ||

\* The peculiarities of the original accentuation and spelling are reproduced.

† Dr. Fischer, like most of the early Russian naturalists, was of German birth and a fellow-student at Leipzig with Tilesius.

‡ Le *Navaga*, qui gelé en hiver est transporté du port d'Arkhangel en très grande quantité à Moscou et à St.-Petersbourg, ou il fait partie des mets délicats qui se consomment dans les deux capitales. Fischer, o. c., p. 252.

§ Tilesius regarded the Russian *navaga* as a variety of the common cod (o. c., p. 253, etc.).

|| In mare boreo versus hyemem magna copia capitur - - ; capitur etiam ad oceanum glacialis oram, usque ad Ob fl. ostia. In balthico deest. Pallas, Zoogr. R. As., v. 3, p. 196.

APPENDIX ON *Eleginus* OF CUVIER AND VALENCIENNES.*ELEGINUS* Cuv. & Val.

The restoration of the name *Eleginus* of Fischer necessitates the suppression of the name *Eleginus* of Cuvier and Valenciennes, proposed in 1830 as the generic designation of a peculiar genus of notothenioid fishes characteristic of the southern Pacific. For the notothenioid genus the term *Eleginops* may be used. *Eleginops* was suggested for two fishes originally referred to *Aphritis* by Jenyns (*A. undulatus* and *A. porosus*). The present author appreciated the relation of those fishes to *Eleginus* (C. V.) about the time he received proof of a "Synopsis of the *Notothenioids*" and appended to that paper an addendum, viz:

NOTE.—After the preceding paper had been forwarded to the Academy, it was discovered that two species (*Aphritis undulatus* and *A. porosus*), referred by Jenyns to the genus *Aphritis*, not only are generically distinct, but belong to a different family, and form a genus nearly related to *Eleginus*, which will be at an early date described as *Eleginops*. *Aphritis* is apparently most nearly related to the genus *Percophis*.\*

On subsequently endeavoring to diagnose *Eleginops*, the author became convinced that there was no generic difference between it and *Eleginus*, and that the two nominal species were probably the young of the typical *Eleginus*. Dr. Günther, in whom the young author had then much confidence, had adopted Jenyns's species, but thought that "the two following species appear to form another genus," viz: "2. *Aphritis undulatus*" and "3. *A. porosus*."† He evidently had no suspicion that they were at all related to *Eleginus*.

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\* Gill, Proc. Acad. Nat. Sc., Phila., 1861, p. 522.

† Günther, Cat. Fishes, iv, 243, 1860.





**LIST OF SHELLS COLLECTED ON THE WEST COAST OF SOUTH AMERICA, PRINCIPALLY BETWEEN LATITUDES 7° 30' S., AND 8° 49' N., BY DR. W. H. JONES, SURGEON, U. S. NAVY.**

BY

ROBERT E. C. STEARNS,

*Adjunct Curator of the Department of Mollusks.*

In the year 1884 the national collection was enriched by the addition of various material collected by Dr. W. H. Jones, of the U. S. Navy, while connected with the U. S. S. *Wachusett*. This acceptable contribution to the Museum included an interesting collection of molluscan forms obtained by Dr. Jones at various points on the west coast of South, Central, and North America, and at the Galapagos Islands. Though a great part of the shells were picked up on the beaches and in poor condition, yet so limited is our knowledge of the distribution of west South American species that the collection has its special value for the information it furnishes upon this point. The preparation for the exhibit of mollusks at the New Orleans Exposition and the pressure of current routine work has been such as to delay the compilation of this list at an earlier day.

Dr. Jones collected in the year 1884, at the following places, at the dates given in his notes, as follows :

Stevens Bay, Chatham Island, Galapagos group, in August; also at Manta and Bahia (Bahia Panguapi), Ecuador, in the same month; at Payta, Peru, in September; at Pacasmayo, also in Peru, in the following month of October. Dr. Jones collected a few species in Panama Bay and on the coast of Lower California, either in the same or some preceding year, while acting as surgeon of the U. S. S. *Narragansett*. Of the Pacasmayo shells he says :

Most of them were found in sand on the side of the cliff from 10 to 20 feet above high-water mark, and but little beach-washed, being mostly weather-worn. The collection shows the comparative abundance of the different species. Recent [fresh] shells very scarce and but few found on the beach. Beach sandy, water deepening gradually; heavy surf; cliffs 50 to 150 feet high, of sand and cobble stones (beach-washed); in many places forming a solid rock of conglomerate.

In numerous instances Dr. Jones's collection carries the species to points much farther south than heretofore published.

The principal localities referred to in this list are, commencing at the south:

Valparaiso, Chile, latitude  $33^{\circ}$  S.  
 Pacasmayo, Peru, latitude  $7^{\circ} 30'$  S.  
 Payta, Peru, latitude  $5^{\circ} 15'$  S.  
 Guayaquil, Ecuador, latitude  $2^{\circ} 11'$  S.  
 Manta, Ecuador, latitude  $1^{\circ}$  S.  
 Chatham Island, Galapagos, latitude  $1^{\circ}$  S.  
 Bahia (Panguapi), Ecuador, latitude  $3^{\circ}$  N.  
 Panama, Colombia, latitude  $8^{\circ} 49'$  N.  
 Cape St. Lucas, Lower California, latitude  $23^{\circ} 4'$  N.  
 Mazatlan, Gulf of California, latitude  $23^{\circ} 20'$  N.  
 Guaymas, Gulf of California, latitude  $28^{\circ}$  N.  
 San Diego, California, latitude  $33^{\circ} 12'$  N.

#### CLASS PELECYPODA

##### 1. *Ostrea ? iridescens* Gray.

Two valves, probably of the above species ; subfossil.  
 Manta.

##### 2. *Anomia lampe* Gray.

One junior with both valves perfect ; seventeen of the left or imperforate valve, of various sizes and colors from silvery white to bright orange.

Payta.

##### 3. *Spondylus princeps* Brod.

Two odd valves.  
 Panama.

##### 4. *Pecten ? tumbezensis* Orbigny.

Three valves (25 to 27 ribs) ovate rather than circular in outline. Probably Orbigny's species.  
 Payta.

##### 5. *Pecten ventricosus* Sby.

+*P. tumidus* Sby. = *P. inca* Orb. C. B. Adams.

Several odd valves easily referable to this species.  
 Payta ; Panama.

##### 6. *Pecten subnodosus* Gray.

Odd valves.  
 Manta.

##### 7. *Pecten purpuratus* Lam.

One large perfect valve.  
 Manta.

8. *Pecten (Vola) dentata* Sby.

A single valve (the flat one).

Payta.

This species extends northward to Monterey, California.

9. *Avicula sterna* Gould.

Fragment of one valve.

Payta.

10. *Mytilus unguatus* Linn.

Three perfect examples and many odd valves.

Pacasmayo.

11. *Mytilus cuneiformis* Rve.

= *M. angustanus* Lam.

Perfect examples and odd valves. Manta; Pacasmayo; Chatham Island, Galapagos.

12. *Mytilus cuneiformis* Rve., variety.

Six examples.

Pacasmayo.

13. *Modiola capax* Conrad.

One valve of a large distorted specimen 4 inches long; also the opposite valve of a small shell  $1\frac{1}{4}$  inches long, obliquely measured; one perfect example with epidermis intact  $1\frac{3}{4}$  inches long agrees with Carpenter's specimens as well as with the description and figures.

Payta.

14. *Modiola capax* Conrad, variety.

Possibly a hybrid between *capax* and *cuneiformis*. One example.

Payta.

15. *Arca (Byssarca) pacifica* Sby.

Odd valves, from  $4\frac{5}{8}$  to  $2\frac{1}{8}$  inches in length.

Payta, Manta, and Bahia.

16. *Arca (Byssarca) gradata* B. & S.

One fresh valve exhibiting the beautiful sculpture of this species to perfection.

Manta.

17. *Arca (Byssarca) solida* Sby.

One valve in good condition.

Payta.

18. *Arca (Anadara) formosa* Sby.

One large valve, dimensions  $5\frac{1}{8}$  by  $2\frac{1}{8}$  inches.

Payta; Manta (1 valve).

19. *Arca* (*Scapharca*) *labiata* Sby.

Four valves.

Bahia.

20. *Arca* (*Byssarca*) *Reeviana* Orb.

A single perfect valve of a young example.

Manta.

21. *Pectunculus* (*Axinæa*) *inaequalis* Sby.

Two valves.

Panama; Payta; one from each place.

22. *Crassatella* *gibbosa* Sby.

Four odd valves of this exceedingly rare species, measuring from  $2\frac{1}{4}$  to  $1\frac{1}{8}$  inches in breadth.

Payta; it ranges northerly to the Gulf of California.

23. *Diplodonta* *obliqua* Rve.

Three odd valves.

Panama.

24. *Cardita* *laticostata* Sby.

One perfect specimen, also odd valves.

Panama.

25. *Chama* *echinata* Brod.

Several odd valves from each of the following places:

Manta; Payta.

26. *Cardium* *senticosum* Sby.

Several odd valves.

Manta; Payta.

The examples from Payta show thirty-six ribs. *C. muricatum*, the Antillean analogue of *senticosum*, has thirty-three. The Mediterranean *C. erinaceus*, a species of quite distinct aspect, also has thirty-six. *C. rastrum* Rve. (Conch Icon. Mon. Cardium, Pl. XVI, fig. 82), is the same as *senticosum* as implied by Reeve's substitution of the latter name for *rastrum* in the index to his monograph.

The number of ribs in *senticosum* as in other related species of the general group that I have examined varies somewhat. Carpenter's Mazatlan examples of *senticosum* show as many as forty.

27. *Cardium* *procerum* Sby.

Numerous odd valves.

Bahia; Manta; Payta.

The characteristic and striking obliqueness of this species so conspicuous in the adults is hardly noticeable in the young shells. The number

of ribs varies from twenty to twenty-five. The *C. laticostatum* Sby. and the *C. Panamense* of the same author, are probably partially grown illustrations of this species, as suggested by Carpenter in his Mazatlan catalogue.

28. *Cardium* (*Fragum*) *obovale* Sby.

One valve.

Bahia.

29. *Cardium* (*Hemicardium*) *planicostatum* Sby.

Odd valves.

Payta; Manta.

This form is very close to the more northern *biangulatum* of the same author.

30. *Cryptogramma subrugosa* Sby.

= *Anomalocardia subrugosa* Sby.

Perfect examples and odd valves.

Panama.

31. *Cryptogramma subimbricata* Sby.

= *Anomalocardia subimbricata* Sby.

Odd valves.

Bahia; Payta.

Dr. Jones apparently failed to detect the first named of this genus south of Panama, though d'Orbigny credits it to Peru; *C. subimbricata*, however, he found at points farther south than before reported. They both reach north to the Gulf of California.

32. *Callista concinna* Sby.

One valve.

Bahia.

33. *Callista circinata* Born.

One valve.

Bahia.

34. *Callista circinata* Born, variety.

One valve only (Mus. No. 48547).

Payta.

35. *Venus* (*Chione*) *columbiensis* Sby.

Odd valves.

Pacasmayo; Payta.

The general facies of this form is suggestive of the *Tapes* (*Unneus*) group so abundantly represented on the west coast, though the heavy hinge line, teeth, and muscular scars indicate its place with *Chione*. Dr. Jones's localities carry this species farther south than before reported.

36. *Venus (Chione) compta* Brod.

Valves only.

Payta; Manta.

This species was described by Broderip from specimens dredged by Hugh Cuming in the Bay of Sechura, Peru; "bottom sand and mud. depth 7 fathoms." Not often met with in collections.

37. *Venus (Chione) amathusia* Phil.

Bahia; Panama.

This beautiful species is also now carried farther south than by previous reports.

38. *Tapes (Cuneus) histrionica* Sby.

Numerous fresh specimens.

Panama.

39. *Tapes (Cuneus) grata* Say.

Dead Man's Island, Bay of Panama.

Carpenter, in his *Mazatlan Mollusca*, has pointed out the differences between this and the foregoing species which appear to be constant. I am quite sure that certain color and sculpture varieties of both of the above have been described as species by various authors, for the facies of the west coast shells of this group varies exceedingly through the character of the local stations at which they occur.

40. *Tapes (Cuneus) antiqua* King.

Several examples.

Dead Man's Island, Bay of Panama.

This species is probably the same as the *Venus costellata* Sby., and the specimens obtained by Dr. Jones recall characters in part of *T. grata* and certain aspects of the Californian *T. staminea* Conrad.

41. *Petricola ventricosa* Desh.

One perfect specimen.

Payta.

42. *Venerupis oblonga* Sby.

† = *Petricola elliptica* Sby. + *P. solida* Sby.

A variable form well represented by numerous good specimens of various sizes.

Payta; Manta (valves).

The specific name *oblonga* has precedence by priority of description over the others.

43. *Donax punctatostriatus* Hanley.

Abundant at the following places; chiefly odd valves.

Pacasmayo; Payta.

**44. *Heterodonax bimaculatus* Orb.**

One specimen.

Panama.

**45. *Tellina punicea* Born.**

Fragments of one valve.

Payta.

**46. *Tellina (Macoma) plebeia* Hanley.**

Portions of one valve.

Panama.

**47. *Tellina (Capsa) excavata* Sby.**

A single valve from each of the following localities:

Payta; Chatham Island, Galapagos.

The figure of the above in Reeve's monograph, without habitat, agrees so well with the shell before me that I feel certain it was made from an example of the same form; it may be that the valves collected by Dr. Jones are a white variety of *T. Dombeyi* of Hanley.

The peculiar form of these shells has led to their being placed here and there by different authors, and *Capsa* has been a sort of catch-all for forms often quite unlike. I have used it in this instance in accordance with Adams's Genera.

**48. *Semele proxima* C. B. Ad.**

One valve.

Panama.

**49. *Semele corrugata* Sby.**

Odd valves.

Payta; Dead Man's Island, Bay of Panama.

**50. *Mactra velata* Phil.**

Odd valves.

Chatham Island, Galapagos; Bahia; Manta; Payta.

The facies of this *Mactra* is quite characteristic and persistent.

**51. *Mactra angulata* Gray.**

Odd valves.

Manta; Panama.

**52. *Solecortus coquimbensis* Sby.**

One adult (both valves), 3½ inches in breadth; also an odd valve of a smaller example.

Payta.

**53. *Solen rudis* C. B. Ad.**

One specimen.

Panama.



54. *Parapholas acuminata* Sby.

Chatham Island, Galapagos.

One valve, beach worn; doubtfully referred to this species.

55. *Pholas* (Barnea) *pacifica* Stearns.

One valve.

Payta.

This species was described by me in the Proceedings of the California Academy of Sciences in 1873,\* from specimens found living on the east shore of San Francisco Bay. It is the west American analogue of the east-coast *P. truncata*, which it much resembles.

It is also reported from San Pedro, California, on good authority.

## Class GASTROPODA.

56. *Siphonaria costata* Sby.

A single example.

Payta.

57. *Gadinia pentagoniostoma* Sby.

A single specimen.

Manta.

58. *Bulla punctulata* A. Ad.

Numerous specimens.

Payta; Pacasmayo; Manta; Chatham Island, Galapagos.

Several specimens were obtained at the localities above named, but only a single dead shell from Pacasmayo. They all exhibit characteristics in common as well as certain differential aspects which warrant the inclusions of *B. aspersa* A. Ad. as a synonym. *B. punctulata* is certainly very close if not identical with *B. Adamsi* Mke. of the Gulf of California.

59. *Terebra* (Myurella) *aspersa* Hinds.

One poor example.

Payta.

60. *Terebra* (Subula) *strigata* Sby.

= *B. elongatum* Wood.

= *T. flammea* Lesson.

= *T. zebra* Kiener.

Two specimens.

Payta.

The National Museum contains an example from Cape St. Lucas which gives the range of over 1,600 miles along the coast of the mainland as compared with the previous published localities, which include a reach of only 240 miles. It is also found at the Galapagos, according to Cuming.

\* Preliminary description published in August 28, 1871.

61. *Conus brunneus* Wood.

Two beach specimens.

Manta. This species indulges in many varieties, to which as many names have been given. Nevertheless with an ample geographical series the relationship of the so-called species based on these aspects of variation to the form known as *brunneus* is made apparent. The samples collected by Dr. Jones correspond with "*C. varius* B., Galapagos, Cuming;" *vide* Reeve's monograph of the cones, plate XLI, fig. 224.

62. *Conus lucidus* Mawe.

One example.

Chatham Island, Galapagos.

63. *Conus purpurascens* Brod.

Payta; Manta; Panama.

Several dead shells. A common and variable form widely distributed.

64. *Conus gladiator* Brod.

A single junior.

Panama.

65. *Cancellaria cassidiformis* Sby.

Beach specimens.

Payta.

66. *Cancellaria clavatula* Sby.

Two examples.

Payta.

67. *Cancellaria clavatula* Sby. variety.

Payta.

68. *Cancellaria mitriformis* Sby.

Pacasmayo.

69. *Cancellaria chrysostoma* Sby.

Nine specimens of this well-characterized species.

Payta.

70. *Oliva peruviana* Lam.

Four of the mottled and striped varieties.

Payta; Chatham Island, Galapagos (one example).

71. *Oliva kaleontina* Duclos.

Two beach shells.

Payta.

72. *Olivella columellaris* Sby.

Twelve specimens.

Payta.

Appears to be closely related to *O semistriata* Gray.

73. *Olivella tergina* Duolos.

Beach shells.

Payta.

74. *Marginella curta* Sby.

Ten examples, beach.

Payta.

75. *Fasciolaria granulosa* Brod.

Two adult examples in good condition.

Panama.

76. *Latirus castaneus* Gray.

Dead Man's Island, Bay of Panama.

77. *Latirus tuberculatus* Brod.

Two beach shells.

Manta.

78. *Latirus ceratus* Gray.

Beach shells.

Dead Man's Island, Panama Bay.

79. *Leucozonia cingulata* Lam.

Beach shells.

Dead Man's Island, Bay of Panama.

80. *Fusus Dupetithouarsii* Kien.

One example.

Chatham Island, Galapagos.

81. *Tritonidea lugubris* C. B. Ad.

A single specimen.

Panama.

82. *Tritonidea Janellii* Kien.= *Purpura Janellii* Kien.

Ten examples for the most part in fair condition; both adult and immature indicate that this form is an unmistakable *Tritonidea* and not a *Purpura*. It is a strongly characterized species, and quite rare in collections. Carpenter, in his "Mazatlan Shells," includes *Janellii* in the synonymy of *sanguinolenta* erroneously. I have handled hundreds of the last-named species, but have never met with an example that suggested a "connecting link" with *Janellii*.

Figure 295, plate 74, Tryon's monograph of "*Cantharus*," is not the species. In the same author's monograph of *Purpura* it is figured as belonging to that genus, Fig. 98, pl. 50.

Payta.

83. *Tritonidea sanguinolenta* Duclos.

One immature fresh specimen.

Manta.

84. *Tritonidea gemmata* Cpr.

One fresh example of ordinary adult size.

Manta.

85. *Tritonidea pagodus* Rve.

In this instance my determination rests upon a badly worn beach specimen of what appears to be a very elongated heavy example of the above species.

This form does not=*fusiformis* Bloc, as stated in Tryon's monograph. Vol. III, p. 262.

Payta.

86. *Tritonidea elegans* Gray.

= *Tritonidea insignis* Reeve.

Two beach shells in bad condition.

Payta.

87. *Engina pulchra* Reeve.

= *Engina reeviana* C. B. Ad.

One beach specimen.

Panama.

88. *Engina carbonaria* Reeve.

One example.

Manta.

The single specimen collected by Dr. Jones is an unusually solid example of this species, which exhibits very considerable variation. In some instances it is short, stumpy, and robust; in others, more or less elongated. Through inadvertence the late Dr. Carpenter, in making up the sets of Mazatlan and Panama shells for the Smithsonian Institution, etc., some of which were distributed years ago, labeled *Engina* or *Sistrum ferrugineum* "*carbonarium*," and this has led to considerable confusion; and the distribution by others in the course of exchanges of the commoner *ferrugineum* as *carbonarium* has extended the error in many collections.

89. *Nassa versicolor* C. B. Ad.

Numerous examples.

Payta; Panama.

Dr. Jones's shells exhibit the well-known and remarkable variability of this species.

90. *Nassa complanata* Powis.

Two examples.

Panama.

91. *Nassa dentifera* Powis.

One specimen.  
Pacasmayo.

92. *Nassa luteostoma* B. & S.

Two specimens.  
Panama.

93. *Columbella fuscata* Sby.

Numerous examples.  
Payta; Manta.  
Several specimens from the first and one from the last locality.

94. *Columbella Paytensis* Lesson.

= *C. spurca* Sby.

Payta; Panama.  
Abundant at Payta; two examples from Panama.

95. *Columbella major* Sby.

Several specimens, beach.  
Payta; Manta; Panama.

96. *Columbella strombiformis* Lam.

Six specimens, beach.  
Manta.

97. *Columbella hæmastoma* Sby.

One specimen.  
Manta.

98. *Strombina lanceolata* Sby.

Seven beach-worn specimens.  
Payta.  
The above exhibit unmistakably the strong characteristics of this species.

99. *Nitidella cribraria* Lam.

One example.  
Panama.

100. *Anachis rugosa* Sby.

A single example.  
Payta.

101. *Anachis fluctuata* Sby.

Numerous specimens.  
Payta; Manta; Panama.

102. *Anachis coronata* Sby.

One specimen.  
Panama.

103. *Anachis serrata* Cpr.

One specimen.

Panama.

104. *Anachis scalarina* Sby.

One example, beach.

Panama.

This form is regarded by some authors as a heavy, coarsely sculptured variety of *A. varia*.

105. *Anachis rugulosa* Sby.

A single example from each place.

Payta; Manta.

106. *Murex (Homalocantha) varicosus* Sby.

A single example  $1\frac{1}{8}$  inches long.

Manta.

Tryon has monographed *M. digitatus* Sby, as a synonym of *varicosus*, but gives a copy of each of Sowerby's figures, apparently copied from the Conch. Illustrations, where *digitatus* is credited to the Red Sea and *M. varicosus* has no locality. Sowerby's descriptions are published in the Proc. Zool. Soc., London, 1840, p. 115. The National collection contains other examples of what appear to be *varicosus* from Acapulco

107. *Murex (Phyllonotus) vittatus* Brod.

One specimen from each locality.

Payta; Manta.

108. *Murex (Phyllonotus) radix* Lam.

Beach shells.

Payta; Panama.

Fragments only of the basal whorl of a large individual from the first locality, and two of the stumpy, many varixed forms from the latter place.

109. *Murex (Phyllonotus) regius* Swains.

Manta; Panama.

An adult beach shell from each of these localities.

110. *Murex (Muricidea) buzea* Brod.

= *Polia buzea* Sby.

Pacasmayo.

111. *Murex (Ocinebra) lugubris* Brod.

= *O. erinaceoides* Val.

Three specimens, beach.

Payta.

112. *Trophon peruvianus* Lesson.= *Purpura xanthostoma* Brod.

One junior, beach.

Payta.

A variable form. Not uncommon in a fossil condition in certain places along the South American coast.

113. *Vitularia salebrosa* King.

One specimen.

Panama.

114. *Purpura undata* Lam

(Rve, Conch. Icon., Mon. Purp., fig. 43.)

Four beach shells.

Payta.

115. *Purpura diadema* Rve.

Numerous examples.

These shells agree with Reeve's figure and description. They are very close to *P. undata* Lam. and to *P. Blainvillei* Desh.

Payta.

116. *Purpura Blainvillei* Desh.

Several specimens.

Payta; Pacasmayo.

117. *Purpura biserialis* Blainv.

A common form.

Manta; Panama.

The relationship, analogy, and synonymy of the form or forms which Carpenter in his Mazatlan shells has included under the specific name of *biserialis*, I do not propose to discuss in this catalogue. To properly indicate the characters, variation, etc., of this protean species intelligibly, would require several figures and elaborate and extended diagnoses.

118. *Purpura callaoensis* Gray.

Fourteen beach specimens.

Payta.

119. *Purpura triangularis* Blainv.= *P. Carolensis* Rve.

One specimen.

Payta.

120. *Purpura melo* Duclos.

Numerous specimens on the beaches, fresh or dead.

Payta; Panama, and Panama Bay on Dead Man's Island; Manta; Chatham Island, Galapagos.

One specimen from Manta was 2½ inches long, with an unusually elevated spire.

121. *Purpura columellaris* Lam.

Three specimens, from 1 to  $2\frac{3}{8}$  inches long.

Manta.

122. *Purpura patula* Linn.

Four fresh specimens, from three-quarters to  $2\frac{1}{8}$  inches long.

Chatham Island, Galapagos.

123. *Purpura patula* Linn, variety.

One fresh specimen between this and *P. columellaris*.

Chatham Island, Galapagos.

124. *Purpura planospira* Lam.

Six specimens,  $1\frac{3}{8}$  to  $2\frac{1}{2}$  inches in length—very heavy.

Manta.

125. *Purpura chocolata* Duclos.

Several specimens.

Pacasmayo.

Although the general facies of this species is quite characteristic, yet it often exhibits much variation. Some individuals have prominent knobs on both the body whorl and the preceding volution, others are noded only on the last whorl. Examples often occur that are smooth throughout, excepting a single strong node near the edge of the outer lip. Again some individuals are chunky, short, and heavy, others have an elevated and somewhat acute spire; the buccinoid aspect of the young shells is noteworthy.

126. *Purpura kiosquiformis* Duclos.

= *Cuma kiosquiformis* Auct.

Beach specimens.

Panama.

It is a quite variable species as remarked by Carpenter. He refers to it as scarce at Mazatlan, but both W. J. Fisher and Henry Edwards collected many examples, several of quite large size at that place. It is also found at other places on the Gulf of California. Dr. Edward Palmer collected numerous specimens at Guaymas; Fisher also found it at Boca de los Piedras, Sinaloa; both farther north than Mazatlan. There is no good reason, as far as shell characters are considered, for placing this and the preceding species in the genus *Cymia*=*Cuma*. The type of *Cymia* is the species *tectum*, which is a markedly characteristic form distinct and distinguished from all the other species that have been associated with it by authors, by the strong angular protuberance or process on the columella, which is a definite and permanent feature, never exhibited or even suggested by any of the others. Many of the so-called *Cumas* are simply *Purpuras*; others might be grouped with *Rapana*.



127. *Monoceros tuberculatum* Gray.+ *Purpura muricata* Gray.

Specimens from each of the following places:

Payta (2); Manta (2); Panama (1); Chatham Island, Galapagos.

The horn in this species is sometimes barely discernible. A specimen of this kind probably led to the description of *Purpura muricata* by the author.

128. *Monoceros brevidentatum* Gray.

Manta (1), beach; Panama (5).

129. *Cymia tectum* Wood.= *Cuma tectum* Wood.= *C. angulifera* Duclos.

Four examples.

Manta.

The specimens of this strongly marked form collected by Dr. Jones vary in length from  $1\frac{1}{2}$  to  $2\frac{1}{4}$  inches, and are very solid. Exterior coloration in some instances of a brownish purple or dull chocolate brown. In one shell the lower is of a lighter color than the upper half. Specimens in the collection collected by the late Thomas Bridges are of a dull buff tint. This form is usually seen in collections under the name of *Cuma*, but Morch's name *Cymia* should be substituted for *Cuma*, which properly belongs to a group of crustacea.

130. *Ianthina fragilis* Lam.= *I. striatula* Cpr.

One imperfect beach specimen.

Chatham Island, Galapagos.

131. *Triton olearium* Linn.

Two examples, adult.

Manta; Payta.

Both specimens are somewhat beach-worn. The larger is from Manta, and measures 5 inches in length. Not before credited to the west coast of America.

132. *Triton Wiegmanni* Anton.= *Argobuccinum nodosum* Chemn. Auct.= *T. Chemnitzii* Gray.

Beach shells, broken.

Payta.

Tryon in his "Manual of Conchology" properly attaches Anton's name to this shell as it has several months priority over Gray's. It has generally been distributed under the other names. Carpenter in his

"Mazatlan Catalogue," as well as in the Smithsonian check list (1860) of west coast shells, has listed this species with Chemnitz's name, and in the Mazatlan sets put up by Carpenter it is so named. In C. B. Adams's Panama shells Gray's name as above is adopted. Tryon gives the geographical range as from "Mazatlan to Panama," but aside from Dr. Jones's shells the national collection contains an example from Payta, which is about 850 miles farther to the south.

133. *Triton gibbosus* Brod.

One good example.

Payta.

134. *Triton lignarius* Brod.

One specimen.

Manta.

Dr. Jones's collection gives both this and the preceding species a much more southerly distribution than previously reported.

135. *Ranella cœlata* Brod.

One specimen badly beach-worn.

Dead Man's Island, Bay of Panama.

136. *Solenosteira purpuroides* Orb.

*Fusus purpuroides* Orb.

*Purpura fusiformis* Blainv.

*Purpura Orbigny* Reeve.

*Fusus purpuroides* Phil.

*Buccinum fusiformis* Soul.

*Fusus fusiformis* Hupé in Gay.

*Neptunea fusiformis* H. & A. Ad.

*Cuma fusiformis* Blainv., Auct.

*Pollia fusiformis* Blainv., Hidalgo.

*Cuma purpuroides* Orb., Tryon.

*Melongenella purpuroides* Blainv., Tryon.

Several specimens.

Pacasmayo; Payta; Manta.

This peculiar form exhibits characters that have heretofore made its generic position somewhat perplexing. Its relations are, however, with a certain group of West American shells that has until recently been included with Adams's genus *Siphonalia*. Tryon has removed some of the West Coast species to *Melongenella*. Among these are *S. pallida* B. & S. and *S. anomala* Reeve, and he should have added *S. modificata* Reeve, if not *S. kellettii* Fbs., of which latter there may be some question; but the others stand or fall by whatever change is made with one. He was on the right track in placing Blainville's *fusiformis* immediately after and following *pallida* in the Manual, for a comparison of several specimens with the large series of *pallida-anomala-modificata* in the National Museum is convincing and clearly indicates the relationship. These latter have, as Dall\* remarks, "been

\* Trans. Wagner Inst., Vol. 3, Part I, page 122, Aug., 1890.

referred to *Rapana* by some writers, while Carpenter, Adams, and others placed it [the group] with *Siphonalia* and Tryon united it with *Melongenina*. These shells normally have an operculum like *Fusus* or *Melongenina*; they do not, therefore, belong with *Rapana*, which has a purpuroid operculum. They are certainly not identical with *Strepsidura* or *Siphonalia* proper. It is highly probable that they are, as supposed by Tryon, related to *Melongenina*. But *Melongenina* is a very well characterized, compact group of large littoral species, having much such a habitat in warm regions as *Purpura*, which they resemble in mode of life. The group in question differs from them in its regularity of sculpture, absence of spines, smaller aperture in proportion to the whole length, small size of the species \* \* \* and the absence of the posterior sinus near the suture, which characterizes the true *Melongenina* when adult. I propose, therefore, to separate the group above discriminated from *Melongenina*, as a genus, hereafter to be reduced in rank if necessary, should more exhaustive researches show its relations to be those of a subgenus rather than a genus. The type will be *Solenosteira* (*Pyrula*) *anomala* Reeve, Couch. Icon., *Pyrula*, pl. VIII, fig. 12, 1847."

137. *Cassia* (*Semicassia*) *abbreviata* Lam.

Several specimens.

Bahia (1); Manta.

Tryon credits this form to the west coast of North America; it will be seen by Jones's localities that it ranges along the South American coast as well. C. B. Adams obtained it at Panama.

138. *Malea ringens* Sby.

Two small adults, one quite heavy though only 1½ inches long.  
Manta.

139. *Oniscia tuberculosa* Rve.

One specimen.

Chatham Island, Galapagos.

140. *Cypræa nigropunctata* Gray.

One beach specimen.

Manta.

Before doubtfully reported from Ecuador, but now confirmed.

141. *Cypræa* (*Aricia*) *punctulata* Gray.

A single beach shell from each of the following places:

Payta; Manta.

This species has been detected as far north as La Paz, Lower California, and in the Gulf of California at Guaymas. Panama was the most southerly point known before Dr. Jones's collection, but this carries it farther south by about 850 miles.

142. *Cypræa (Aricia) arabicula* Lam.

Payta (4); Manta (1).

Tryon's Manual credits this species to Acapulco and Gulf of California. Prof. C. B. Adams reported seven specimens on the reef at Panama.

143. *Cypræa exanthema* Linn.

Payta (1 junior); Manta (2).

Heretofore reported from Panama northward.

144. *Cypræa Sowerbyi* Kiener.

Two beach specimens.

Payta.

Reeve, in *Conch. Iconica*, gives a very fair figure of this species, but as confounded it with *C. picta* when referring to the habitat. *C. picta* is a well-known African species. Tryon credits *Sowerbyi* to the Gulf of California, but it has a more northerly range as well; the extreme southerly distribution is indicated by Dr. Jones's examples.

145. *Cypræa (Pustularia) pustulata* Lam.

One example, beach.

Panama.

146. *Strombus gracillior* Sby.

Two specimens.

Manta.

Panama is the most southerly locality previously given.

147. *Strombus granulatus* Swains.

Manta; Panama.

Dr. Jones's collection gives this species also a more southerly locality than before published.

148. *Strombus peruvianus* Swains.

One specimen from each place as follows:

Payta; Manta.

149. *Cerithium maculosum* Kiener.

Several examples, beach.

Bahia; Manta; Chatham Island, Galapagos.

150. *Cerithium stercus-muscarum* Val.

Three specimens.

Panama.

151. *Cerithium interruptum* C. B. Ad.

Six examples, very solid, knobby, and black.

Manta.

Must not be confounded with Menke's *interruptum*.

152. *Modulus disculus* Phil.

Three specimens.

Panama.

Previously credited to Acapulco and Mazatlan.

153. *Planaxis planicostata* Sby.

Eleven beach shells.

Panama.

154. *Serpulorbis squamigera* Cpr.

Manta; Payta.

155. *Bivonia compacta* Cpr.

One specimen.

Payta.

156. *Turritella Broderipiana* Rve.

= *T. marmorata* Kiener.

Several specimens.

Payta; nine from 1½ to 6 inches in length. Manta, one specimen.

One semifossil, of large size, must have been 6 inches in length when perfect.

157. *Turritella cingulata* Sby.

= *T. tricarinata* King.

One specimen.

Manta.

In some places on the coast of Chile this is a common fossil.

Sculpture variable. Often more than tri-carinate, and in some instances the keels are broken into little beads.

158. *Turritella gonistoma* Val.

var. = *T. Banksii* C. B. Ad.

Several examples.

Manta (3); Panama (18).

159. *Tectarius atyphus* n. sp.

One fresh specimen (Mus. No. 48396).

Manta.

The first example of this group detected on the west coast of the American continent.

160. *Litorina peruviana*, Lam.=*L. zebra* Wood.

One young specimen.

Payta.

161. *Litorina varia* Sby.

Two specimens.

Panama.

162. *Litorina conspersa* Phil., variety.

Two examples.

Payta.

163. *Mitrularia cepacea* Brod.=*Calyptra cepacea* Brod., auct.

One fractured specimen.

Manta.

Carpenter, in Smithsonian Check-list (of West Coast shells), 1860, catalogues this by the latter name.

164. *Crucibulum spinosum* Sby.

Generally distributed.

Bahia (1); Payta (20); Manta (2); Chatham Island, Galapagos (1).  
Extends northward to Monterey Bay, California.

165. *Crucibulum imbricatum* Sby.

Nine examples from one-half to 2½ inches diameter.

Payta; Manta (1).

166. *Crepidula aculeata* Gmelin.

Sixty-two specimens in various conditions and of all sizes, from tiny adolescent examples to strong adult shells.

Payta.

167. *Crepidula dilatata* Lam.

Beach shells.

Pacasmayo; Manta.

168. *Crepidula strigata* Brod.

Two specimens.

Pacasmayo.

169. *Crepidula arenata* Brod.

Five; four adult.

Payta.

When in a perfect state an exceedingly pretty shell, pinkish inside, fading to a light yellowish brown around the edge, and the edge mottled with dark brown.

170. *Crepidula Lessoni* Brod.

One at each place.  
Bahia; Payta.

171. *Crepidula excavata* Brod

Four specimens.  
Payta.

172. *Trochatella radians* Lam.

- = *Trochita radians* Lam., Auct.
- = *Infundibulum radians* Orb.
- = *Infundibulum radians* Mont., Tryon.

Beach shells.  
Bahia.

The generic name *Trochita*, which is in general use for this form, must yield to *Trochatella* of Lesson, as adopted by Fischer in his *Manuel de Conchyliologie*, 1887. Schumacher's genus *Trochita* rests upon the Chinese form, *Galerus chinensis* Lam. (Adam's Genera), a shell that is externally white or whitish and smooth under a fibrous epidermis and the type of Lamarck's genus *Calyptrea*. Tryon's use of Montfort's name *Infundibulum* in Vol. VIII of his Manual on page 121, no doubt arose from his confounding it with Orbigny's *Infundibulum*. Montfort's includes a group of the top-shells *Trochidæ*, and is so used and properly by Mr. Pillsbry in his continuation of Tryon's work in Vol. XI, pp. 7-24, and Orbigny's is a synonym of Lesson's *Trochatella*, which rests upon a variety of this West Coast form and has precedence over Orbigny's by six years. Orbigny's name is barred in any event by the priority of Montfort's.

The generic term of *Trochatella* was subsequently used by Swainson for a section or group of the *Helicinidæ*, and is therefore a synonym; in place of it Fischer has given the name *Eutrochatella*.

For reference to Schumacher in connection with the above, see his *Nouv. Syst. etc.*, p. 184, Copenhagen, 1817; and for Lesson's, see his "Voyage de la Coquille," etc.

173. *Hipponyx antiquatus* Linn.

One example from each.  
Payta; Chatham Island, Galapagos.

174. *Hipponyx barbatus* Sby.

Three specimens.  
Manta; Galapagos Islands.

175. *Natica (Polinices) uber* Val.

Payta (numerous); Manta (two examples); Panama, nine specimens.  
"Ten to twenty feet above high-water mark" [W. H. J.].

176. *Natica unifasciata* Lam.? = *N. maroccana* Chem. var.

Two specimens.

Panama.

Carpenter includes this, and no doubt properly, in his synonymy of *Natica maroccana* Chem. (Maz. Cat. sp. 570) as variety *b*. It is by no means a certainty as to whether Chemnitz's name or Lamarck's was originally applied to West American shells. There will be less confusion, however, to let these names remain as they now stand than to make a change that will probably bring us no nearer to the facts.

177. *Natica* (Ruma) *otis* B. & S.

One specimen, bleached, but perfect.

Payta.

178. *Sigaretus concavus* Rve.= *S. Grayi* Desh.= *S. cymbia* Mke.= *S. maximus* Phil.

Several specimens.

Payta.

Varies much, as do many of the related *Naticas*. Tryon credits this species to San Pedro, California. (Manual, Vol. VIII, p. 55.)

179. *Patella araucania* Orb.

Two examples.

Payta.

180. *Acmaea scutum* Orb.

One beach shell from each place.

Payta; Chatham Island.

181. *Acmaea Preteri* Orb.

A single specimen.

Payta.

The solitary beach shell which is here catalogued, though much rubbed, nevertheless exhibits the characteristics of this species.

182. *Turbo magnificus* Jonas.

Several specimens.

Callao; Payta; Manta.

This form suggests a smooth-surfaced variety of the more northerly *tessellatus* or *fluctuosus*.

183. *Turbo* (? *Senectus*) *squamiger* Reeve.

Several examples; beach.

Payta; Manta.

This is a rare species, and it may belong in the group *Callopona*. The national collection series exhibits an extended range, stretching



from La Paz and the Gulf of California to Dr. Jones's southernmost locality, or from  $24^{\circ} 30' N.$ , to  $5^{\circ} 15' S.$  latitude. Colonel Jewett collected it at Acapulco, where it was also obtained by myself in May, 1868. Mr. W. J. Fisher found it living at the Tres Marias group at the mouth of the Gulf of California.

184. *Turbo (Callopoma) fluctuosus* Wood.

- = *T. fluctuatus* Reeve.
- + *T. Mollikianus* Reeve.
- = *T. Fokkei* Jonas.
- = *T. assimilis* Kiener + *T. tessellatus* Kiener.
- † = *T. depressus* Cpr.
- † = *T. funiculosus* Kien., Cpr.

Several beach shells.

Payta; Guayaquil; Manta.

An exceedingly variable shell for one of this group, but nevertheless having a common facies which, when a large series is brought together, satisfactorily indicates the reasons for the above synonymic arrangement. Tryon (Manual) gives the distribution, "West coast of America from Gulf of California northward," but Cuming obtained it at "Punta St. Elena," which is on the coast of Guayaquil in lat.  $2^{\circ} 10' S.$  It will be seen that Dr. Jones's collection carries it still further south to latitude  $5^{\circ} 15'.$  Carpenter, in the "Mazatlan Catalogue," credits it to Sitka, on the testimony of Wosnessenski in Middendorff; this is no doubt an error, as to its actual northerly range; though it is not improbable that a dead shell might have been obtained there, from either ballast refuse dumped overboard or from its having been dropped by some sailor belonging to a whaling ship; for the whalers formerly cruised all along the coast from Magdalena Bay, Lower California, to and through the Alaskan waters.

Carpenter also credits *T. fluctuosus* to San Diego, California; this has not been corroborated by any subsequent collector, though it is not improbable that Lieutenant Green may have detected it at this place for the species extends northerly along the outer coast of Lower California, where it has been detected at various places as well as at Cerros Island.

185. *Turbo (Callopoma) saxosus* Wood.

Several examples; beach.

Payta; Manta; Panama.

Tryon refers to *T. nitzschii* Anton ("*Mitzzhii* Anton" Sby.) and *T. venustus* Phil., as synonyms.

The National Museum collection shows the range to be from Payta as above northerly to Cape St. Lucas and up the Gulf of California to Guaymas, where it was collected by Dr. Edward Palmer several years ago.

186. *Turbo* (*Prisogaster*) *niger* Gray.

Common; numerous specimens.

Pacasmayo.

On beach and 10 to 20 feet above high-water mark.

187. *Astrarium* (*Uvanilla*) *Buschii* Phil.

= *U. inermis* Kiener.

Many examples.

Payta; Manta; Panama.

This shell is generally seen in collections with Kiener's name *inermis* Gmel. attached, but Philippi's has priority by 7 years. One of the nine specimens from Manta measured  $1\frac{7}{8}$  inches in diameter and  $1\frac{1}{4}$  inches altitude.

188. *Pomaulax undosus* Wood.

Beach shell.

Ballenas Bay, Lower California.

189. *Chlorostoma ater* Lesson.

= *C. atrum* Lesson Pilsbry.

Abundant.

Pacasmayo.

190. *Chlorostoma gallina* Fbs. var.

Beach shells.

Santa Margarita Island, off Lower California.

191. *Omphalius panamensis* Phil.

Three beach shells.

Payta.

Heretofore credited only to Panama.

192. *Omphalius viridulus* Gmel.

Eight examples—four from each of the following places:

Manta; Panama.

A somewhat variable species. The Manta shells are of various sizes, and exhibit greater variation in this respect than those from Panama.

In using the specific name *viridulus*, I have followed Carpenter in his Mazatlan Catalogue, as well as specimens distributed by him, and so labeled. Pilsbry has given the above name to the East Coast form, which is closely related, and to the West Coast form is assigned a *varietal* position with the name *reticulatum*. It is not unlikely that he is right, but as he has reduced to a *varietal* status other related forms, I retain the first name as above, until time will permit a careful comparison of the various species so combined.

193. *Omphalius aureotinctus* Fbs.= *Chlorostoma aureotinctum* (Fbs.) Auct.

Beach shells.

Santa Margarita Island, off Lower California.

194. *Tegula pelliserpentis* Wood.

Beach shells.

Panama; and from Dead Man's Island, Panama Bay.

This form though well characterized specifically, is hardly entitled to generic distinction.

195. *Nerita scabricosta* Lam.

Several specimens.

Manta; Panama.

The Manta example is of unusual size, being quite large, like Galapagos specimens.

196. *Nerita Bernhardi* Recluz.

Common at the latter place.

Manta (one); Panama.

Manta is a more southerly point than before reported.

197. *Neritina guayaquilensis* Sby.= *Neritina intermedia* Sby.

One specimen.

Payta.

C. B. Adams, in *Panama Shells*, p. 206, says: "This may, according to Recluz, be identical with *N. intermedia* Sowb. It is certainly identical with shells which have been distributed by Mr. Cuming and by Mr. Petit under the latter name. Mr. Sowerby's figures,\* however, seem to represent two species."

It is quite evident to anyone familiar with the West American *Neritinae*, upon an examination of the figures and text of this group in Tryon's Monograph, that he has considerably mixed them; and Sowerby, as Adams suggests, has contributed to the confusion. The form referred to by Adams, as well as the shell collected by Dr. Jones, is that figured in Sowerby's *Conchological Illustrations*, Figs. 7, 7. Specimens agreeing with the above figures, determined by Cuming, have been distributed as Professor Adams states. The Monograph of the *Neritinae* in the "Conch. Illustrations," has precedence over the later "Thesaurus" Monograph, by eight years.

Sowerby in the former work credits *intermedia* to the "Bay of Montejo and the Gulf of Nicoya." The former is in Veragua, on the south side next west of the Bay of Panama, and the latter in Costa Rica, on the west coast, lat. between 9° and 10° N. Dr. Jones's collection extends the range southerly nearly 800 miles.

\* Thes. Conch., p. 520, No. 44, Pl. 114, Fig. 177.

198. *Fissurella rugosa* Sby.

Nine specimens.

Payta.

Carpenter's comments (Mazatlan list) upon the variability of this species rest on his examination of "thousands of specimens." As many as a thousand have been examined by me at various times, and I can add my testimony as corroborative of Carpenter's.

Mr. Pilsbry has recently described *F. rubropicta* from Lagoon Head, mainland of Lower California, opposite Cedros or Cerros Island. His specimens were collected by Mr. Hemphill, and the National Museum was kindly presented with three of the same lot. They are much heavier and more elevated than any specimens of *rugosa-macrotrema* in the National collection, and on the whole not as elongated, but nevertheless appear to be quite closely related. The crimson stain that suggested the name *rubropicta* is not unusual in either *rugosa* or *macrotrema*. The Museum series of *rugosa*, etc., includes a large number of selected specimens, over a hundred, and one-quarter as many of *macrotrema*, so called, from various localities on the West Coast.

199. *Fissurella virescens* Sby.

Several examples.

Payta; Manta; Panama; Chatham Island, Galapagos group.

At Payta it appears to be abundant; Manta, two examples, beach; Panama, one fresh; and five rather small specimens from the Galapagos.

The late Thomas Bridges collected a large number of the above and the following at San Juan del Sur, Nicaragua; also in Panama Bay and elsewhere on the west coast of Central America.

200. *Fissurella nigropunctata* Sby.

= *F. virescens* Sby., variety.

One specimen.

Panama.

Mr. Pilsbry in his "Manual" makes *nigropunctata* a variety of *virescens*, a conclusion that is unavoidable after a careful examination of a large series. The same author intimates other differences than color, if these are not obvious; the ample series before me show that the color spots are all there is upon which a varietal distinction can rest.

201. *Fissurella peruviana* Lam.

= *F. occidentalis* Gld.

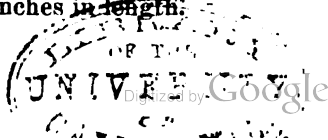
Seventeen specimens, in various conditions.

Pacasmayo.

202. *Fissurella maxima* Sby.

A single large, heavy example, nearly 4 inches in length.

Manta.



203. *Fissurella picta* Gmel.

A single specimen, hardly typical.

Manta.

204. *Lucapinella inæqualis* (Sby.), Pilsbry.

= *Glyphis inæqualis* Sby.

One specimen.

Manta.

Mr. Pilsbry has recently separated several species heretofore assigned to *Glyphis* and other genera, and brought them together under the above name of *Lucapinella*; having detected a difference in the character of the dentition, which varies from that of the forms and groups with which they had been previously associated.

205. *Lucapinella alta* (C. B. Ad.), Pilsbry.

*Glyphis alta* C. B. Ad.

Five specimens.

Payta; described from Panama by the author, where he collected numerous examples.

206. *Lucapinella callomarginata* Cpr.

= *Glypidella callomarginata* Cpr.

One example (Mus. No. 48509).

Payta.

The specimen collected by Dr. Jones is perfect in every respect. The orifice has more of the keyhole shape than any of the others in the National collection. A comparison of the Museum series shows considerable variation in this character. Carpenter illustrated this in his "Report to the British Association," 1856, plate 7, by numerous figures, and we may reasonably expect to find mutations in the form of the orifice in this as well as in the *Fissurellas* proper.

A beach-worn example of what is probably the above species, was obtained years ago (1837-'40) by the United States exploring expedition, under command of Wilkes, at Valparaiso (Mus. No. 19135).

The Jones and Exploring expedition specimens extend the distribution further to the south than heretofore reported by about 1,700 miles, Mr. Hemphill's Lower California examples from San Ignacio Lagoon, being the southernmost to this date. The largest specimens in the Museum are Postpliocene fossils from San Diego, collected by Hemphill, the principal specimen measuring over 25 millimetres in length.

207. *Chiton (Corephium) spiniferus* Trembly.

= *C. tuberculiferus* Sby.

= *C. echinatus* Barnes.

+ *C. aculeatus* Barnes, Auct.

Payta.

208. *Chiton (Lepidopleurus) janeirensis* Gray.

One anterior plate.

Payta.

The above determination rests upon a single plate (anterior) in good condition.

Of the 211 species contained in the above list,\* 90 are carried farther south than heretofore reported, by 64 miles, the least, to 3,195, the greatest extension in range; also one species detected not before collected or reported, and one new species and genus added to the fauna of the coast.

The increase in southerly range of these 90 is as follows:

Under 100 miles.....	1
Between 100 and 200 miles.....	24
Between 200 and 300 miles.....	4
Between 300 and 400 miles.....	5
Between 500 and 600 miles.....	11
Between 700 and 800 miles.....	2
Between 800 and 900 miles.....	32
Between 900 and 1,000 miles.....	1
Between 1,400 and 1,500 miles.....	3
Between 1,700 and 1,800 miles.....	5
2,520 miles.....	1
3,195 miles.....	1

## ADDITIONS AND CORRECTIONS.

Following 62, on page 315, add—

62a. *Conus nux* Brod.

One example from beach. Chatham Island, Galapagos.

63a. *Conus princeps* Linn.

One beach shell of the fine-lined variety.

Payta.

Following 126, on page 321, add—

126a. *Concholepas Peruvianus* Lam.

One specimen.

The National Collection also contains examples from Callao and Valparaiso.

On page 317, number 85, read—

This form does not=*fusiformis* Blve., not Bloc, as printed.

\* Including these additional species given below.



DESCRIPTIONS OF NEW GENERA, SPECIES, AND SUBSPECIES OF  
BIRDS FROM COSTA RICA.

BY

GEORGE K. CHERRIE,

*Taxidermist and Ornithologist of the Costa Rica National Museum.*

Through the kindness of the authorities of the Smithsonian Institution I have been permitted to compare the specimens contained in a small collection of birds brought with me from Costa Rica with the more extensive series belonging to the U. S. National Museum, every facility for the work being given me, together with assistance by the curator of the Department of Birds, as well as by Dr. Leonard Stejneger, especially in the matters of nomenclature and synonymy.

Notes on additional species are deferred until I can return to Costa Rica and have access to the large collection belonging to the Museo Nacional at San José.

In the following descriptions I have employed Mr. Ridgway's nomenclature in the naming of colors.

*Lophotriccus squamieristatus minor*, subsp. nov.

Mr. Ridgway having directed my attention to the decided difference in color between the Costa Rican birds and true *squamieristatus*, from Colombia, I have made a careful examination of the birds from the two localities and deem the differences such as to warrant the separation of the Costa Rica bird as a good geographical race, which I have named *minor* from its smaller size. From the true *squamieristatus* it is readily distinguished by the slightly brighter olive-green above, by the decidedly more yellowish or yellowish-green color below and its extension farther onto the breast, the under wing coverts being a little deeper yellowish, and lastly, in smaller size, the wing measuring 1.90-1.96, instead of 2.05-2.16, and the tail 1.68-1.72, instead of 1.82-2. (Type No. 35305 ♂, U. S. National Museum, Grecia, Costa Rica, December 1, 1864; F. Carmiol.)

*Lophotriccus zeledoni*, sp. nov.

Another bird from Costa Rica in the U. S. National Museum collection deserves attention, differing as it does from both *squamieristatus* and *squamieristatus minor* in being bright olive-green above, with a brownish shading on the hind neck. On the head the crest feathers are not nearly so well developed, the color at their base being not nearly



so deep a black, while the rufous tips and edges are broader; the wings and tail are dusky, the latter edged with the color of the back and the former with olive-yellow, brightest and lightest on the inner secondaries; lesser wing coverts like the back, middle coverts lighter like the edging to the remiges, greater coverts with similar edges but having an orange shade. Below, chin and throat grayish white; breast, sides, and flanks greenish-yellow; abdomen and under wing coverts yellow (nearly the primrose of Ridgway's "Nomenclature".) Striations on the under parts are obsolete. The size is considerably smaller; wing, 1.70; tail, 1.50.

To this apparently new bird I have given the name *Lophotriccus zeledoni*, taking pleasure in this opportunity to show some appreciation to Sr. Don José C. Zeledon for many favors, personal and otherwise.

The type of the new form is No. 47492, Collection U. S. National Museum, Dota, Costa Rica, October 4, 1867; F. Carmiol.

*Pachyrhamphus ornatus*, sp. nov.

Adult female (type No. 42951, collection U. S. National Museum, Barranca, Costa Rica, February 26, 1866; J. Carmiol); above olive-green, wings and tail dusky-blackish, rectrices broadly tipped with cinnamonaceous, primaries and secondaries edged with the same color, the inner secondaries broadly so; wing coverts tipped with tawny-cinnamon, greater and middle series broadly so. Crown and neck rufous-chestnut; supraloral stripe extending to just above the eye and including the nasal plumes on the forehead, white; lores blackish. A supra-auricular stripe extending from above the eye and crossing the occiput, black. Below, chin whitish, throat and breast greenish olive-yellow, abdomen and crissum canary-yellow; axillaries under wing coverts and inner edges of quills pale yellowish. Maxilla dusky blackish; mandible dusky plumbeous; feet and legs dusky.

Length of wing, 2.86; tail, 2.53; exposed culmen, 0.54; nostril to tip of bill, 0.42; gonys, 0.34; tarsus, 0.74.

HABITAT: Costa Rica.

*Deconychura*, gen. nov.

Like *Sittasomus* and *Glyphorhynchus* in the great extension of the stiffened stems of the rectrices beyond the webs of the feathers, but having ten rectrices instead of twelve. The bill is very like that of *Sittasomus*, slightly compressed for the terminal half and slightly depressed and widened for the basal half; gonys just appreciably ascending; bill a little longer in proportion, being as long as the head. The pattern of coloration is much as in *Glyphorhynchus*, being uniform above, the throat lighter colored and the breast spotted, but the pattern on the wing is very different from either the latter or *Sittasomus*, both of which have the secondaries and inner primaries marked with a conspicuous light patch on the inner webs, followed by a darker

area, the tips like the outer webs. In *Deconychura* the inner webs of the remiges are paler, but there is no lighter patch. The generic name here chosen refers to the peculiarities of the tail, with ten rectrices having the stiffened stems extended beyond the webs and bent down, being derived from *δεκα* ten, *οὐρῆ* claw, and *οὐρα* tail.

*Deconychura typica*, sp. nov.

Adult female (type No. 119943,\* collection U. S. National Museum, Pozo Azul, Costa Rica, September 7, 1889; J. C. Zeledon); above light bistre with umber-brown shading; feathers of the crown with blackish edgings and narrow faint buffy shaft streaks, these shaft streaks also seen on the hind neck. Wings, tail, and upper tail coverts between a chocolate and chestnut brown; wing coverts like the back; remiges shaded on the edges with the color of the back. Lores, superciliary stripe and sides of head soiled buffy or pale clay color, with dusky blackish or brownish shading. Chin and throat pale clay color; remaining lower parts light olive-brown with umber shading; feathers of the breast with blackish edges and central guttate spots of pale clay color, the spots growing fainter posteriorly until on the crissum they are only represented by faint shaft streaks. Under wing coverts ochraceous, inner edges of quills vinaceous cinnamon with an ochraceous shade. "Feet, legs, and lower mandible plumbeous; upper mandible black; iris dark brown" (Zeledon, MS.).

Wing rather long, third and fourth quills longest, first equal to eighth, second longer than fifth.

Length, 7.00; wing, 3.56; tail, 3.96; culmen, 0.92; nostril to tip of bill, 0.58; gony, 0.52; tarsi, 0.80.

HABITAT: Costa Rica and Panama.

There is another specimen in the U. S. National Museum from Panama (Aspinwall) in immature plumage and with the bill broken off at the nostrils.

*Premnoplex*, gen. nov. (type, *Margarornis brunnescens* Lawr.).

I have before me four of the six recognized species of the genus *Margarornis*; namely, *squamigera*, *stellata*, *rubiginosa*, and *brunnescens*. The latter presents peculiarities in the pattern of coloration and structure that have led me to place it in a new genus, *Premnoplex*,† which I would characterize as similar to *Margarornis*, but wing short and rounded, and much more concave, while the second primary is shorter than the sixth, not longer; quills only faintly edged with lighter on the inner webs and no patch at the base of the feathers, extending to the shaft on the inner webs of a pale fulvous color. This light-colored area in *squamigera*, *stellata*, and *rubiginosa*, commences on the third primary and extends across the secondaries, increasing in length along the web on each suc-

\* No. 3320, collection Museo Nacional de Costa Rica.

† *Προυν* = trunk of tree and *πηρῶ* = strike.

ceeding feather. From descriptions I find the light patch at the base of the quills is present in *perlata* and *guttata*. In the new genus the nostrils open in a narrow slit at the posterior part of the nasal fossæ, while in the species of *Margarornis* before me the nasal opening is at the forward end of the nasal fossæ.

*Vireo superciliaris*, sp. nov. (Ridgway MS).

(Type No. 91825, U. S. National Museum, Birris, Costa Rica, 1882, J. Cooper:) Similar to *V. carmioli*, but darker olive-green above; below, paler, more inclined to sulphur-yellow with less olive shading on the breast and sides, while the under tail coverts are almost primrose-yellow; the lores are black, the cheeks and ear coverts olive-brownish, the latter fading gradually into the olive-greenish of the back. The white spot below the eye, including the white of the lower eyelid (central part only, not the entire eyelid), seems to be better defined. In addition to the differences noted above it is considerably larger, measuring: wing, 2.68; tail, 2.30; exposed culmen, 0.43; nostril to tip of bill, 0.30; while true *carmioli* measures, wing, 2.47-2.50; tail, 2.14-2.20; exposed culmen, 0.38-0.41; nostril to tip of bill, 0.25-0.28.

The present bird comes from the southwest coast region, while the two examples of *V. carmioli* examined came from the high interior of the country. Nothing is known of the habits of either of the birds. That the bird in hand is separable from typical *carmioli* can not be doubted, yet the relationship must be very close while a good series of specimens might show them to be inseparable as species. In the mean time it seems to me *Vireo carmioli superciliaris* would better indicate the relationship of the two birds.

*Basileuterus delatatrii*

I have eighteen Costa Rica specimens and five others from Guatemala, Veragua, Panama, and Bogota, that compared with Mr. Sharp's description of the type of *mesochrysus* (Cat. B. Brit. Mus. x, pp. 396-397) seem in a slight way to differ from that type. Mr. Sharpe writes: "A line of black across the forehead extending to the eye; upper and under edge of the eyelid white; lores and anterior and posterior edge of the eyelid, extending a little behind the eye, black; ear coverts, chestnut; behind the ear-coverts a white spot mixed with chestnut." In each of the eighteen Costa Rican examples and the ones from Bogota and Veragua this black line "across the forehead" is present, sometimes, however, only faintly (separated from the black lores by the white superciliary stripe that extends from the nostrils to the nape), averaging one-tenth of an inch wide, in no instance "extending to the eye." In the Guatemalan example it is entirely wanting; while in the two from Panama there are only a few dusky feathers at the extreme forehead. Costa Rica specimens, the ones from Guatemala, Bogota, and Veragua, and the two from Panama, all have the "under edge of the eyelid

white," this sometimes extending below the eye in an ashy whitish line to the forepart of the cheek; in some it is almost obsolete; in none of the specimens before me is there white on the "upper" eyelid. The black of the lores extends around, above, and behind the eye. None of the Costa Rican nor the Guatemalan examples show more than a trace of the "white spot mixed with chestnut behind the ear-coverts."

Costa Rica specimens have a dark rich chestnut crown and ear-coverts, the feathers of the crown usually tipped, especially posteriorly, with grayish olive; from the nape this latter color passes gradually into the rather dark olive-green of the back. The white spot back of the ear-coverts is in most cases only faintly indicated.

The specimens from Veragua, Bogota, and Panama have the head and ear-coverts rufous-chestnut; the grayish olive of the nape passes rather abruptly into the olive-green (brighter than in Costa Rica examples) of the back, and there is a white spot back of the ear-coverts, this white spot consisting of the feathers on the posterior edge of the auricular orifice, which are blackish at the base, but with white tips; the chin, forecheek, and infraocular line are more whitish than in Costa Rica specimens.

The Guatemala bird is distinguished from all the other examples by the more extended rufous-chestnut crown (in color like Veragua and Pauama birds), including the occiput, and the entire lack of a grayish-olive collar on the hind neck. The infraocular whitish stripe extends below the ear-coverts.

Viewing the material before me, and noting the comparisons I have just made, it is evident that either the Guatemala or Costa Rica bird should be separated under a new name. It might be supposed that there would be little question but that the Costa Rican was the one to be separated, but after a careful examination of the literature on the subject I am convinced that the Costa Rica bird is *Basileuterus delatirii* Bp., not *mesochrysus* Sel., and that it is the Guatemalan bird that ought to be named.

Bonaparte in his original description of *delatirii* distinctly says (Notes Orn., p. 62) "espece nouvelle de *Nicaragua*." Why Messrs. Salvin and Godman doubt Delattre's specimen having come from Nicaragua (Biol. C. A., Aves, I, p. 176) I do not know. Certain it is, Bonaparte's description\* applies much better to the Costa Rica bird than to the one from Guatemala, in which latter bird the chestnut of the head is not confined to the pileum, but embraces "*pileo cum nucha*" as in *rufifrons*; besides, there is indication of a median stripe in the crown, which is not to be found in Costa Rica examples.

\*"Traete viridis subtus omnino flavus, genisque castaneis; superciliis albis."

"Dans le *rufifrons* la couleur est moins brillante "*cinereo virens*" et le roux de la tete est plus etendu "*pileo cum nucha costaneis*." De plus au voit sur la tete "*litura longitudinali verticis albid.*"

*Basileuterus salvini*, sp. nov.

I shall call the Guatemala bird *Basileuterus salvini*, and select as type No. 30700, U. S. National Museum, from Coban, Vera Paz, November 15, 1859 (received from O. Salvin). This is the bird described by Professor Baird as *B. delatirii* in his "Review of American Birds," p. 249, and I can not do better than reproduce his description: "Similar to *rufifrons* in color of head, the olive-green of the back brighter, this color invading and replacing the ashy of the nape and sides of the neck; the infraocular white band, less distinct behind, but apparently extending behind the eyes. Whole under parts greenish yellow, a little paler on middle of belly; flanks olive-green; the sides behind and crissum tinged with fulvous. Wings much rounded, about equal to the lateral tail-feathers; first quill shorter or not longer than the secondaries, as is the case in *rufifrons*."

With the above arrangement the geographical distribution of the species would be about as follows: *Rufifrons* is confined to Mexico, *salvini* to Guatemala, *delatirii* to Nicaragua and Costa Rica, while *mesochrysus* occupies the territory south into Colombia.

The two latter are closely related and it seems questionable if the two forms do not intergrade. The chief difference appears to be in a darker head and a darker olive-green of the upper parts in general of the Costa Rica bird, the white spot behind the ear-coverts is, I believe, an untrustworthy character, and the grayish nuchal band is hardly more so. Accordingly, I would reduce *mesochrysus* to subspecific rank, making it *Basileuterus delatirii mesochrysus* (Selater).

*Grallaria lizanoi*, sp. nov.

Similar to *G. perspicillata*, but ashy above, with olive shading on the back, the back markings confined to very narrow (almost obsolete) fulvous shaft-streaks. Below, the black stripes on breast and sides are much broader. The black rectal stripe is clearer and better defined.

*Adult male* (type No. 119951,\* U. S. National Museum, Trojas, Costa Rica, January 1886, Anastasio Alfaro): Above, ashy or slate-gray, the back shaded with olive; inter-scapulars with faint fulvous shaft-streaks; wings and tail sepia-brown; primaries broadly edged (including almost the entire web) with ochraceous; median and lesser wing-coverts and scapulars olive brownish tipped with buffy; greater coverts vandyke-brown tipped with burnt-sienna; † primary coverts clove-brown. Below white, the breast and sides more or less buffy; broad black stripes on the breast, extending to the flanks but growing less distinct posteriorly. Flanks and sides have an olivaceous shading. Under surface of the wing ochraceous. "Bill black; base of lower mandible white; legs and feet very light plumbeous." (Zeledon MS.)

\*No. 628, Coll. Museo Nacional de Costa Rica.

† This is probably a character of the young or seasonal, as a May example has the greater coverts like the median and lesser ones.

*Grallaria lizanoi* is an inhabitant of the Pacific coast side of the Cordillera, while *dives* and *intermedia* seem confined to the Atlantic side, the former ranging north into Nicaragua, while the latter is, I believe, a bird confined more to the southeastern "*tierra caliente*" of Costa Rica, possibly extending to Panama.

I take pleasure in naming this beautiful species of ant thrush after the Hon. Don Joaquin Lizano, minister of state of the Republic of Costa Rica, to whom so much is due for the material advancement and intelligent progress of various institutions of the country, including especially the Museo Nacional.

***Pachyrhamphus cinereiventris* and allied forms.**

Young males are similar to the females; in some specimens, just assuming the adult phase, a part of the rectrices have white tips and part have cinnamonaceous tips; the same peculiarity is seen in the primaries and secondaries.

Adult male birds from Costa Rica, differ from "Bahia" birds, labeled *polychroptera*, not only in the smaller size, but in having the under wing-coverts and axillaries plain slate-gray, like the breast. The "Bahia" birds have the axillaries and under wing-coverts more or less mottled with white, and the bend of the wing whiter.

There are two other birds, male and female, in the U. S. National Museum collection, from Greytown, Nicaragua, that while closely allied to both *cinereiventris* and *polychroptera*, have peculiarities sufficient, in my judgment, to separate them from either, as well as they (the two latter) are separated one from another. In fact, I believe sufficient material would show the three to be races of but a single species.

The male, like that of *cinereiventris* and *polychroptera* has the back black; head shining steel-bluish black; rump grayish; under parts slate-gray. But the bill is decidedly larger\* than either of its allies, the wing and tail are equal to those of *cinereiventris* and smaller than in *polychroptera*. The female has the back and head more olive-greenish and the lower parts paler than females of *cinereiventris*, which latter species has also the back more or less tinged with brownish.

For this Nicaragua bird, in case future material may prove more conclusively its distinctness, I would propose the name *Pachyrhamphus similis*.

***Arremon aurantirostris*.**

Examining a series of these birds from the Atlantic and Pacific sides of the Cordillera, the birds from the Pacific side represented by specimens from Panama north through Veragua into Costa Rica, those from

	Exposed culmen.	Nostril to tip of bill.	Jaws.	Width of bill at base.
* No. 40448, ♀, June 4, 1865. H. E. Holland.....	0.56	0.44	0.40	0.32
No. 40447, ♂, June 11, 1865. H. E. Holland.....			0.40	0.32

the Atlantic side by examples from Colon (Aspinwall), Costa Rica, Nicaragua, Honduras, and Guatemala, there are seen certain differences that appear to be constant and which do not seem to be due to age, season, or sex.

A male (true *aurantiistrois*, I believe) from Pozo Azul, Costa Rica (Pacific side), (No. 1178, Museo Nacional de Costa Rica, January, 1887, J. C. Zeledon) may be described as follows: Above, olive-green; head, black, with a median vertical cinereous stripe; superciliary stripe, ashy white, whiter anteriorly and more ashy posteriorly; wings and tail, dusky brownish edged with olive, that on the tail much the darker; bend of wing, lemon-yellow. Below, sides of face and chin, black; throat, white; pectoral band, black; sides and flanks, slate-gray, tinged with olive on the flanks; center of belly, white; under tail-coverts, brownish-gray. October and December birds from the same locality show little variation; but a bird taken in May, 1884, a female (No. 101833, U. S. National Museum, Pozo Azul, Costa Rica, J. C. Zeledon), has the stripe on the head darker grayish. The olive-green is perhaps a shade brighter, while in the center of the back are a few brownish feathers (the same color—nearly a chestnut—as on the bird described by Cassin as *rufodorsalis*, No. 39041, U. S. National Museum). The black pectoral band is not so well defined, the sides and flanks are washed more with grayish olive, the abdomen is buffy, the under tail-coverts brownish (sepia). Another example from Panama has the under tail-coverts a wood-brown.

A male from Choctum, Vera Paz (Guatemala) (No. 20421, U. S. National Museum, Vera Paz, January, 1860, O. Salvin), may be described as follows: Above, dark olive-green, a brownish shading on the upper tail-coverts; head, black, median vertical stripe, gray; superciliary stripe, white; wings and tail, dusky brownish or blackish, edged with brownish olive-green. On the tail the edging is only visible at the base, where it is very dark; bend of wing, light orange-yellow; below, sides of face and chin, black; throat, white; broad black pectoral band; center of breast, white, shading into buffy white on the abdomen; sides and flanks olive-brown, with faint shadings of olive-green; under tail-coverts clove-brown. Two specimens from Talamanca, Costa Rica, male and female, taken in April, have the sides and flanks more decidedly washed with olive-green, the under tail-coverts a trifle lighter (sepia-brown), while the bend of the wing is a bright orange yellow. Another Costa Rica specimen (No. 1175, Museo Nacional de Costa Rica) is probably melanistic. Above it is dark brownish olive green; wings, tail, and tail-coverts dark brownish (clove-brown), tail and coverts darkest, with scarcely a shade of olive edging except on the wing-coverts; bend of the wing is rather bright orange-yellow; below the center of the breast is white, and only a shade of buffy on the abdomen; sides and flanks, brownish olive; under tail-coverts, sepia-brown. An example from Los Sabalos, Nicaragua, a female, taken in April, has the back a little brighter olive,

the bend of the wing is not so decidedly orange, and below the sides and flanks are grayish brown with a faint shade of olive. Another Nicaraguan bird has the superciliaries almost as grayish as Pacific Coast birds and the back almost as bright. A specimen from Aspinwall has the superciliaries grayish posteriorly; the back as bright as Panama examples, but the sides and flanks are more brownish gray.

Thus while it will be seen that the Atlantic and Pacific forms can hardly be separated by hard and fast lines, yet the Atlantic form seems always separable, having white superciliaries, a darker back, a darker yellow bend to the wing (orange, not lemon), the sides, flanks, and under tail-coverts more brownish and less grayish. While some of these characters may fail, all will scarcely fail in the same bird; and the darkest or typical birds from the Atlantic side differ so decidedly from typical examples of the Pacific form that I am loath to class them as one bird. Accordingly in case a larger series of specimens may prove the differences constant as they seem, I would suggest the name *Arremon aurantirostris saturatus* for the dark-colored bird found on the Atlantic side.

*Myrmeciza intermedia*, sp. nov.

An examination of the allied forms of *Myrmeciza*, including my recently described *occidentalis* (Auk., VII, April, 1891), has led me to conclude that Costa Rica has yet another form allied to *immaculata*, the habitat of which extends from the southeastern coast region of Costa Rica (Talamanca) to Panama. For this apparently new form I have chosen the name *intermedia*.

*Adult male* (Type, No. 64715, U. S. National Museum, Sipurio, Talamanca, Costa Rica, April 8, 1873, J. C. Zeledon). Similar to *immaculata*, but having the under primary-coverts concolor with the quills, and the first primary only faintly, if at all, edged with white. Just a trifle smaller.

In the original description of *immaculata* (P. Z. S., 1864, p. 357) no mention is made of the color of the under wing coverts, nor of the white edging to the first primary, only saying "*campterii margine albo*." However, as examples with the first primary distinctly edged with white (as well as the alula) and the under primary-coverts white, tipped with ashy, do not seem to extend north of the Talamanca coast of Costa Rica, and as the type came from Panama, I take it as probable that it is this form (with white under primary-coverts) that is referred to.

*M. intermedia* extends from Panama along the Atlantic lowlands in Costa Rica to Nicaragua. It was, of course, with this form that I made my comparisons in describing *occidentalis*, the males of which differ but slightly from those of *intermedia*, while the females are quite distinct. Unfortunately we have no authentic females of *immaculata*.

*M. exsul* seems to differ from the three more northern forms in having the inner edges of the remiges ashy whitish, and in being much lighter



colored above and below. Like *immaculata*, the first primary is distinctly edged with white, but the apical white spots on the wing-coverts are much larger.

*M. occidentalis* is confined to the west coast region of Costa Rica (and possibly Veragua), while *M. intermedia* is on the east side from Nicaragua to Panama, where it intermingles with *immaculata*, which extends as far north as Talamanca.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH  
COMMISSION STEAMER ALBATROSS.

No. XXI.—DESCRIPTIONS OF APODAL FISHES FROM THE TROPICAL  
PACIFIC.

BY

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The interesting assemblage of eels here reported upon was obtained, with one exception, in 1888 during the investigations of the *Albatross* in the region around Panama and the Galapagos Islands. *Ophisoma macrurum* was obtained the following year in the Gulf of California, and it is here included because of its close relationship to some of the forms discussed.

*Chlopsis equatorialis*, sp. nov.

Body extremely slender, little compressed, tapering posteriorly to a very narrow tail, which is, however, not filamentous. Depth about one-fortieth of the total length.

Head long and slender, somewhat as in *Nettastoma*, the lower jaw shorter than the upper, the eye nearly over the angle of mouth.

Posterior nostril a long horizontal slit immediately in front of the lower margin of eye. Anterior nostril minute, subtubular, near tip of snout. Eye  $3\frac{1}{2}$  in snout.

Snout very soft. A series of slit-like mucous pores along margin of upper jaw, and a series of round pores along lower jaw. A transverse series on occiput connecting the lateral lines.

Gape  $2\frac{3}{4}$  in head. Maxillaries slender, extending well forwards, abutting against the vomer immediately behind its head. Both jaws and vomer with wide bands of short sharp conical teeth, the inner series in the jaws slightly longer than the others. Band on shaft of vomer reaching back to front of posterior nostril.

Branchiostegal rays long and much bowed, curving around behind and above the opercles.

Gill openings with their margins much curved, forming four-fifths of a circle. Their vertical diameter nearly equals that of eye, and is more than twice the length of the interspace separating them below. Tongue apparently undeveloped.

Head  $2\frac{3}{4}$  in body (head and trunk); the body  $3\frac{1}{2}$  in tail.

Dorsal beginning behind the head at a distance equaling one fourth the length of head.

Color dusky-olive, dotted with coarse brown specks everywhere except on under side of head and on fins. A blackish streak on median line of belly. Fins translucent.

This species has not the appearance of a deep-sea eel, though the intestine is protruded through the anus in the type specimen, as the result of the release of pressure. A single specimen  $14\frac{1}{2}$  inches long, said to have been taken at Station 2792, off the coast of Ecuador, in 401 fathoms.

***Xenomystax* gen. nov. (*Muraenesocidae*.)**

Scaleless. Pectorals well developed. Vertical fins large, continuous around the tail, the rays evident. Dorsal beginning before base of pectorals.

Gill slits vertical and rather wide, the gill membranes continuous below the throat.

Branchiostegals apparently eleven or twelve in number, long and much curved, continuing around the posterior and upper edges of opercles. Mouth with wide lateral cleft, not extending far beyond the eye. Maxillary very wide, not extended far forwards, the clasping processes applied to shaft of vomer well behind its head.

Teeth all conical, slender, and sharp, mostly depressible, those in jaws in wide bands. Maxillary with a deep lengthwise groove, running the entire length of bone and dividing the band of teeth into two portions. Lower jaw much shorter than the upper.

Posterior nostril a linear slit, midway between eye and tip of snout; the anterior in a short tube just behind the head of vomer. Tongue, small, with the tip free. Lips undeveloped. Lateral line conspicuous.

A deep-water form, with thin skin and black coloration, most nearly related to *Muraenesox*, but differing in the peculiar structure of the jaws and in the dentition.

(Type, *Xenomystax atrarius* sp. nov.)

***Xenomystax atrarius*, sp. nov.**

Snout very long and slender, the gape wide; end of maxillary equidistant from tip of mandible and gill opening. Front of orbit over the beginning of last third of length of gape. A series of long slit-like mucous pores along margin of upper jaw; a conspicuous series on mandible and preopercle.

Teeth in jaws in wide bands, mostly depressible, the outer series of teeth laterally shortest and not meeting in closed mouth. The maxillary teeth divided by a deep groove running entire length of jaw, those on inner side of groove long, close set, rigid, in a single series. Mandible with a much narrower and shallower groove, on the inner edge of which is a single series of very small conical teeth, directed

inwards. Tip of mandible enlarged to form a knob which fits into a toothless depression just behind head of vomer, the vomer extending well beyond the tip of lower jaw. Teeth on head of vomer and knob of mandible similar, slightly larger than those on sides of jaw. Anterior part of shaft of vomer (immediately behind depression for tip of mandible) with a median series of strong conical teeth, the largest in the mouth. These are usually accompanied by smaller lateral series, and followed by a narrow band of very small conical teeth which reach backwards to middle of mouth.

Length of head equal to that of trunk, and one-third that of tail. Posterior line of occiput midway between front of dorsal and middle of eye.

Gill openings broadly lunate, the upper margin continued as a membranous fold across base of pectorals. The vertical length of the slit is one-third of the snout, and the two are separated by an interspace two thirds the length of the slit.

Pectorals narrow, one-half snout.

Color very dark brown, the fins black, the pores of the lateral line white.

A single specimen, 18 $\frac{3}{4}$  inches long, from Station 2792, in 401 fathoms.

### OPHISOMA SWAINSON.

#### KEY TO THE SPECIES OF OPHISOMA.

- a. Vent submedian, the body and tail about equal in length. Upper jaw but little projecting, lips thin. .... BALEARICUM
- aa. Vent anterior in position, the tail much longer than the body.
  - b. Snout short and broadly rounded, but little projecting beyond tip of mandible. Tail nearly twice length of body. .... MACRURUM, sp. nov.
  - bb. Snout long and acute, projecting well beyond tip of mandible.
    - c. Tail less than twice length of body.
      - d. Eye large, equaling snout, 5 in head. .... MYSTAX
      - dd. Eye small, one-half snout, 8 in head. .... PRORIGERUM, sp. nov.
    - cc. Tail much more than twice length of body. .... NITENS

#### *Ophisoma balearicum* ? Delaroche.

Four immature specimens from the Bay of Panama, taken at a depth of 33 fathoms (Station 2797), are provisionally referred to this species. They agree perfectly with the descriptions of *O. compressum* Poey and *O. mellissii* Günther, and show in addition a brownish-black blotch below the eye not noted in descriptions of other species. From the current descriptions of *O. balearicum* they differ in the larger mouth, the maxillary reaching to below the middle of the eye. It is probable, however, that adults of all the species of *Ophisoma* agree in this respect. Direct comparison of specimens from the Mediterranean with those from the West Indies and from the tropical Pacific may show them to be specifically distinct, but it seems more advisable for the present to consider *balearicum* a widely distributed form agreeing in

this respect with its near ally, *Leptocephalus conger*. *Ophisoma anago* may also be properly referred to this species.

The specimen from Cape St. Lucas, catalogued by Jordan and Gilbert as *Leptocephalus conger* (Procs. U. S. National Museum, 1882, 378), has been reëxamined by me and found to belong to this species. *L. conger* is therefore as yet unknown from our Pacific coast.

The following is a detailed description of the Pacific specimens:

Cleft of mouth scarcely reaching to below middle of eye,  $3\frac{1}{2}$  in head. Lower jaw shorter than the upper, but less so than in related species; the lips thin, and the upper not forming a projecting proboscis. Posterior nostril a short linear slit in front of the eye; the anterior with a very short tube near tip of snout. Teeth small, conical, sharp, uniform in size, in broad bands in mandible and on vomer, extending back on shaft of vomer in a narrow, V-shaped patch, which does not reach beyond posterior nostril. Maxillary with a narrow band or irregular double series. None of the teeth enlarged.

Length of the gill slit two thirds the diameter of eye, and equal to or slightly less than the interspace between the two slits.

Head  $2\frac{1}{3}$  to  $2\frac{2}{3}$  in body,  $5\frac{1}{2}$  to 6 in total; the vent nearly median.

Dorsal beginning in advance of gill-slit, the occiput midway between front of dorsal and posterior margin of pupil. Pectorals rather long,  $2\frac{2}{3}$  in head.

Color light olive, with minute dusky specks. Margins of vertical fins narrowly black. Head more or less silvery on sides and below, with a distinct dusky blotch below orbit. Eye silvery below, the iris otherwise dusky.

*Ophisoma prorigerum*, sp. nov.

Related to *O. mystax* and *O. nitens*, differing from the former in the much smaller eye and from the latter in the much shorter tail.

Snout long and sharp, the acute soft tip protruding beyond the mandible for over two-thirds the length of orbit.

Mandibles very broad and strong; the gape decurved posteriorly, reaching to vertical from posterior margin of pupil. A conspicuous pore just behind angle of mouth. Distance from tip of snout to angle of mouth one-third distance to base of pectorals.

Teeth villiform, in broad bands, none of them enlarged. A transverse groove behind head of vomer to receive tip of mandible.

Posterior nostril slit-like, the anterior on each side of tip of snout with a short distinct thin membranous tube.

Mucous pores small, several at tip of snout, and three in upper lip, the posterior one distinct from the others and below front of pupil.

Eye small, one-half of snout,  $8\frac{1}{3}$  in head, slightly less than length of gill-slit.

Head equal trunk, one third the length of tail without fin; depth one-thirteenth of total length.

Pectoral two-sevenths length of head. Dorsal beginning in advance of gill-opening, its distance from tip of snout slightly less than half distance from snout to anal.

Uniform light-brownish. Fins dusky, jet-black near tip of tail, where they have a narrow bright white margin. Mouth, gill cavity, and peritoneum black.

The type is a single specimen,  $10\frac{1}{2}$  inches long, taken at Station 2792, in 401 fathoms. A second small specimen was obtained at Station 2799.

*Ophisoma macrurum*, sp. nov.

Snout comparatively short and heavy, blunt and broadly rounded, projecting but little beyond the lower jaw; lips full.

Teeth in mandible in a broad band, those of outer series strong and obviously larger than those of inner series. Maxillary and vomerine teeth also in broad bands, none of the former enlarged, some of the anterior and middle vomerine teeth corresponding in size to the outer series in mandible. Vomerine patch divided by a transverse groove into which fits the tip of the mandible. No teeth on shaft of vomer.

Posterior nostril an elliptical slit on level of upper margin of pupil. Anterior nostril a round pore near tip of snout. Tip and lower margin of snout with five large slit-like mucous pores on each side, the last one under the posterior nostril.

Gape extending slightly beyond pupil,  $2\frac{3}{4}$  in head. Eye moderate, three-fourths of snout, 6 in head, the diameter of pupil equal to width of interorbital space.

Head  $1\frac{1}{2}$  in trunk (without head), 4 in tail, the latter therefore, nearly twice the length of body. Depth one-fifteenth of total length.

Pectorals one-third of head, the fold from upper edge of gill-slit attached to its base below. Origin of dorsal slightly behind base of pectorals, its distance from tip of snout one-half that from tip of snout to front of anal.

Color dusky above, the under side of head and abdomen white, the two areas separated by a well-defined line. Fins dusky, becoming black towards tip of tail, with a well-marked whitish border. Inside of mouth, gill-cavity, and peritoneum silvery.

A single specimen,  $9\frac{1}{2}$  inches long, from the Gulf of California, Station 3015.

*Ilyophis* gen. nov. (*Ilyophidæ*.)

Body scaly. Pectorals developed. Lateral line prominent. Gill-slits horizontal, inferior, well separated. Nostrils lateral, the posterior immediately in front of eye, the anterior with a short tube, near tip of snout.

Maxillaries as in *Synaphobranchus*, the clamping processes closely appressed to the side of the vomer behind its head. Lower jaw strong, apparently with the coronoid process well developed. Series of teeth

on head and shaft of vomer continuous. No lips. Tongue little developed, with narrow, free margin. Branchiostegal rays fifteen in number (as determined without dissection), not shortened, some of them curved around and above the opercle.

Dorsal, anal, and caudal confluent, rather high, the rays clearly visible through the skin. Dorsal beginning well forward, its origin immediately behind the base of pectorals. Origin of anal near end of anterior end of body.

This eel combines the general physiognomy of *Synphobranchus* with the separate gill-slits and long, bowed branchiostegal rays of *Simenchelys*. It may be considered provisionally the type of a family distinct from either.

(Type, *Ilyophis brunneus*, sp. nov.)

*Ilyophis brunneus*, sp. nov.

Body narrow, compressed throughout. Snout and jaws slender, the gape half the length of the head, and extending beyond the eye for a distance less than the diameter of the latter. Maxillary teeth small, bluntly conic, in a narrow band. Teeth on vomer large, conic, those on shaft of vomer in a single row, not continued backwards beyond middle of orbit. Teeth in mandibles in a narrow series similar to those in maxillaries, but those of the inner series enlarged and retrorse, though less than half the size of vomerine teeth.

A series of pores near margin of upper and lower jaws. Front of pupil over end of second third of length of jaw. Lower jaw strong, not flexible, the coronoid process apparently strong (not dissected out).

Gill-slits narrow, inferior, horizontal, crescent-shaped, about equal to horizontal diameter of eye; their lower (anterior) ends separated by a distance equal to their own length, their upper (posterior) ends by  $1\frac{1}{2}$  times that distance.

Head one-half length of trunk. Body  $3\frac{1}{4}$  in total. Pectorals small, one-sixth of head, the rays evident. Scales very fine, arranged in groups at right angles to each other. Lateral line running high anteriorly, its pores white and conspicuous; the lateral line ceases before it reaches the end of the tail, which is scaleless.

Color brown; the fins, lower side of head, and branchial region darker.

A single specimen, 15 inches long, from Station 2803, 634 fathoms, (near Chatham Island, Galapagos).

DESCRIPTION OF A NEW SPECIES OF CHAMÆLEON FROM KILIMANJARO, EASTERN AFRICA.

BY

LEONHARD STEJNEGER.

*Curator of the Department of Reptiles and Batrachians.*

*Chamæleo*\* *abbotti*, sp. nov.

*Diagnosis.*—Neither gular, nor ventral, nor dorsal crest; snout ending in two compressed and serrated scaly appendages; no trace of occipital dermal lobes; body granular, irregularly intermixed with numerous rounded tubercles; a parietal crest.

*HABITAT.* Kilima-njaro, East Africa, 4,500 feet altitude.

*Type.* U. S. National Museum, No. 16744. Named in honor of its discoverer, Dr. W. L. Abbott, of Philadelphia, Pennsylvania.

*Description of type specimen.*—Casque broad and rather flattened, only moderately elevated behind; a distinct, though low, parietal crest not reaching the apex of the casque; the distance between the corner of the mouth and the apex of the casque equals that between the former and the tip of the snout; lateral crest surrounding the casque posteriorly, tubercular; superciliary crest considerably raised, rounded and tubercular; two compressed, scaly rostral appendages, or horns, diverging anteriorly, each with three serrated ridges of large pointed scales, one above and one lateral, the latter in direct continuation of the superciliary ridge and canthus rostralis; top of head symmetrically covered with numerous irregular scales and granules of various sizes; no trace of occipital lobes; body granular with two or three indefinite rows of irregular flat tubercles on each side of the upper half between the lateral "pavement" series and the median dorsal line; no tubercles, or spines, on the latter, which is covered with minute granules; no gular nor ventral crests; no tarsal process; tail longer than body and head including horns. Color (in alcohol) plumbeous, with indications of a whitish spot below and behind the eye and continued posteriorly in an indistinct and interrupted stripe over the shoulders; throat pale.

In addition to the type specimen, there are two more specimens from the same locality, agreeing in all essential points with the above description.

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\* This is the spelling adopted by the founder of the genus, and consequently the one to be employed to the exclusion of the more commonly accepted *Chamæleon*.

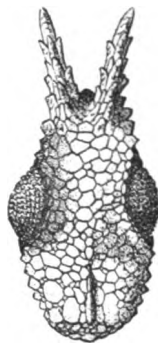


## Dimensions in millimeters.

U. S. National Museum numbers.....	16744.	16743.	16745.
Total length from tip of snout to tip of tail.....	175	194	197
From tip of snout to posterior end of mandible.....	18	19	16
From tip of snout to apex of casque.....	23	26	25
Length of rostral process from base anteriorly.....	10	10	11
Distance between tips of rostral processes.....	8	8	9
Greatest width between lateral cranial crests.....	11	12	12
Tibia.....	14	16	15
Tail.....	96	110	107

Until quite recently the horned chamæleons of this particular group were supposed to be confined to Madagascar only. In 1887, however, Dr. Reichenow described a *Chamæleo fischeri* from some mountain region in Central Africa, a species apparently related to *Ch. bifidus* from Madagascar. From this, as well as from all other two-horned chamæleons known to me, the present form differs at once by the total absence of either a dorsal, gular, or ventral crest. Another notable feature in the present species is the continuation of the superciliary crests into the lateral crests of the horns.

The collection brought home by Dr. Abbott and generously donated to the Museum also contains four specimens of *Chamæleo roperi*, recently described by Mr. Boulenger (P. Z. S., 1890, p. 85, pl. VIII, fig. 4), from the same locality. I find the characters ascribed to this form quite constant.



Head of *Chamæleo abbotti*, seen from above.  
About  $1\frac{1}{2}$  times natural size.

## THE GENUS *PANOPEUS*.

BY

JAMES E. BENEDICT AND MARY J. RATHBUN.

*Department of Marine Invertebrates.*

(With Plates XIX-XXIV.)

This paper is based upon the study of twenty-four species of *Panopeus*, specimens of all of which have been examined by the authors. Fourteen other species and one variety, described by various writers, have not been seen by us; nevertheless, we give the synonymy and short descriptions. The material examined is contained chiefly in the National Museum, and has been derived from the following sources: The large collections made by Mr. Henry Hemphill on the coast of Florida from 1883 to 1885; the collections of the U. S. Fish Commission from the coasts of the Eastern States from 1875 to date, including those made in the investigation of the oyster grounds of Long Island Sound; the Fish Commission collections made in the net-work of rivers and creeks of the coast of South Carolina during the past season, in the West Indian region in 1884, and in the Gulf of California; the smaller collections made by Dr. Edward Palmer, Lieut. J. F. Moser, U. S. Navy, Dr. D. S. Jordan, Mr. W. H. Dall, Mr. Silas Stearns, and Mr. S. T. Walker, on the Florida coast; by Commander R. D. Evans, U. S. Navy, in Chesapeake Bay; by Mr. W. Nye, jr., in Buzzard's Bay; by Mr. W. M. Gabb, in San Domingo; by Mr. L. Belding, in the Gulf of California; by Mr. R. Rathbun, on the coast of Brazil, in 1875-'76; by Mr. G. Brown Goode, in Bermuda, 1876-'77. Through the courtesy of Prof. A. E. Verrill, the collection of *Panopeus* in the Peabody Museum of Yale University, was placed at our service, and yielded three species additional to those represented in the National Museum series.

We do not agree with Prof. A. Milne Edwards in his separation of the genus into *Panopeus* and *Eurypanopeus*, for in accepting his classification *depressus* would be placed with forms having a lobate division of the antero-lateral margin; *crenatus* and *transversus*, with very convex carapaces, would be placed with those most flattened; and *crenatus* alone of *Eurypanopeus* would possess the character of the exposed seventh segment of the male sternum, and the sternal canal for the verges. Nor can we agree with Stimpson in separating *Eurytium* from

*Panopeus*, as the exposure of the seventh sternal segment varies with the species, as does the size of the palatal ridge. The two species which have been placed in *Eurytium* have but little in common, except the two rounded lobes of the front. It would seem that if a division of the genus *Panopeus* should eventually be made, it must be on other lines and more definite characters. It can hardly be said that we have extended the limits of a genus which already contains *Panopeus herbstii* and *P. harrisii*.

The genus is American with the exception of one species from the west coast of Africa and two from the Indo-Pacific region.

The first species was described and figured by Thomas Say, in Jour. Acad. Nat. Sci. Phila., I, 1817, under the name of *Cancer panope* Herbst, to which species he had mistakenly referred it. Milne Edwards, in his classical work published in 1834, established the genus *Panopeus*, and under the name of *P. herbstii* entered as synonyms *Cancer panope* Herbst and *C. panope* Say, believing them to be one and the same species, thus continuing the mistake of Say, which has been followed by numerous authors. Prof. S. I. Smith, in the Proc. Boston Soc. Nat. Hist., XII, 1869, points out the error, and in 1872 Prof. von Martens in the Arch. für Natur., 38, refers to the original specimen of *Cancer panope* Herbst in the Berlin Museum as a *Menippe*, thus confirming the view taken by Professor Smith.

In the waters of Long Island Sound the indigenous species are found abounding on the oyster beds, very often in the dead shells of oysters and other lamellibranchs when the valves remain together and partly open. They move slowly and clumsily, and no doubt remain for long periods in the same place of concealment, watching for food to come to them. Farther south they are found near high-tide mark in holes in the banks along with *Gelasimus* and *Sesarma*. In deeper water they live among sponges, corals, dead shells, and clusters of oysters, or in any object that will afford concealment. Many of the species are not easily distinguished and only careful comparison will acquaint one with them. We have examined over three thousand specimens belonging to the different species which we have referred to *Panopeus*.

In the following descriptions the antero-lateral teeth are designated as first, second, third, and fourth. The first is the tooth next the outer angle of the orbit, and the fourth is the posterior tooth.

The numbers in parentheses after the names of localities are taken from the catalogue books of the National Museum. Wherever it was impossible to verify the synonymy, we have placed the quotation in parentheses.

#### GENUS *PANOPEUS* Milne Edwards.

*Cancer*. Thomas Say, Jour. Acad. Nat. Sci. Phila., I, p. 57, 1817.

*Panopeus*. Milne Edwards, Hist. Nat. des Crust., I, p. 403, 1834. J. E. DeKay, Crust. of N. Y., p. 5, 1844. Gay, Historia de Chile, Zool., III, p. 138, 1849. H. Lucas, Hist. Nat. des Crust., p. 89, 1851. J. D. Dana, Crust. U. S. Ex. Ex., pp. 149, 179, 1852.

H. de Saussure, Mém. Soc. Phys. Genève, xiv, p. 431, 1857. W. Stimpson, Ann. Lyc. Nat. Hist. N. Y., vii, p. 54, 1859. S. I. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 275, 1869. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, 1, p. 306, 1880. W. A. Haswell, Cat. Australian Crust., p. 51, 1882. H. W. Conn, Stud. Biol. Lab. Johns Hopkins Univ., iii, No. 1, pp. 4-9, figs., 1884. E. J. Miers, Challenger Rept., Zool., xvii, p. 128, 1886.

*Eurytium*. W. Stimpson, *Loc. cit.*, p. 56. A. Milne Edwards, *Loc. cit.*, p. 332. E. J. Miers, *Loc. cit.*, p. 140.

*Eurypanopeus*. A. Milne Edwards, *Loc. cit.*, p. 318.

Orbit interrupted by an external hiatus, below entire. Antero-lateral margin thin, often shorter than the postero-lateral and directed toward the external angle of the orbit. (Dana, *loc. cit.*, p. 149.)

#### ARTIFICIAL KEY TO SPECIES EXAMINED.

- A'. Antero-lateral border cut into teeth.
- B'. Dactyl of large hand with a large basal tooth.
- C'. Carpal groove present.
- D'. Fingers light.
  - E'. Outline of male abdomen slightly concave, terminal segment rounded ..... *bermudensis*
  - E''. Outline of male abdomen very concave, terminal segment pointed ..... *hemphillii*
- D''. Fingers dark.
  - E'. Carpus smooth or nearly so.
  - F'. Seventh sternal plate in male exposed ..... *angustifrons*
  - F''. Seventh sternal plate in male not exposed.
  - G'. Front faintly four-lobed ..... *occidentalis*
  - G''. Front produced, much rounded ..... *packardii*
  - E''. Carpus rugose.
  - F'. Antero-lateral teeth thickened vertically ..... *haritii*
  - F''. Antero lateral teeth thin ..... *serratus*
- D'''. Fingers variable. Front grooved ..... *wurdeemannii*
- C''. Carpal groove wanting or indistinct.
- D'. Anterior margins of antero-lateral teeth nearly perpendicular to the median line. Front thickened, truncate ..... *areolatus*
- D''. Antero-lateral teeth pointing slightly forward. Front beveled ..... *herbetti*
- D'''. Antero-lateral teeth strongly hooked forward ..... *validus*
- B''. Dactyl of large hand without a large basal tooth.
- C'. Male abdomen with five segments.
- D'. Terminal segment triangular.
  - E'. Fingers black ..... *sayi*
  - E''. Fingers white ..... *texanus*
- D''. Terminal segment rounded.
  - E'. Fingers black ..... *depressus*
  - E''. Fingers white ..... *harrisi*
- C''. Male abdomen with six segments ..... *dissimilis*
- A''. Antero-lateral border cut into dentiform lobes.
- B'. Carapace convex.
- C'. Seventh segment of sternum exposed, separating the third segment of abdomen from the coxæ of the fifth pair of feet.
- D'. Front with two well-rounded lobes ..... *limosus*
- D''. Front with margins of lobes straight or nearly so ..... *crenatus*
- C''. Seventh segment of sternum not exposed ..... *transversus*

A". Antero-lateral border cut into dentiform lobes—Continued.

B". Carapace flattened.

C'. Carpal groove present.

D'. Outline of coalesced tooth convex.....*oratus*

D". Outline of coalesced tooth emarginate.....*parrulus*

D'''. Outline of coalesced tooth emarginate. Carapace absolutely flat.

*planissimus*

C''. Carpal groove wanting.

D'. Color of finger running up on hand.....*planus*

D''. Color restricted.....*affinis*

Note.—*Hemphillii*, *packardii*, *harttii*, and *wurdemanni* occasionally lack the large tooth on the dactyl.

# 1. *Panopeus herbstii* Milne Edwards.

Plate XIX, figs. 1 and 2; plate XXIII, figs. 10-12.

*Cancer panope*. Thomas Say, Jour. Acad. Nat. Sci. Phila., 1, pp. 58, 447, pl. 4, fig. 3, 1817.

*Panopeus herbstii*. Milne Edwards, Hist. Nat. des Crust., 1, p. 403, 1834. J. E. De Kay, Crust. of N. Y., p. 5, 1844. Lewis R. Gibbes, Proc. Boston Soc. Nat. Hist., 2, pp. 63, 69, 1845; Proc. Acad. Nat. Sci. Phila. v, p. 23, 1850; Proc. Amer. Assoc. Adv. Sci., 3, p. 175, 1850. Adam White, Crust. in Brit. Mus., p. 18, 1847. H. Lucas, Hist. Nat. des Crust., p. 90, 1851. Joseph Leidy, Jour. Acad. Nat. Sci. Phila. (2), III, p. 17, 1855. W. Stimpson, Amer. Jour. Sci. (2), 29, p. 444, 1860. Camil Heller, Reise Fregatte Novara, Bd. 2, Abth. 3, p. 16, (1864) 1868. S. I. Smith, Proc. Boston Soc. Nat. Hist., XII, p. 276, 1869; Trans. Conn. Acad., II, p. 34, 1869; Rept. U. S. Commr. Fisheries for 1871-'72 (1874), pp. 547, 472. Elliott Cones, Proc. Acad. Nat. Sci. Phila. (3), 1, p. 120, 1871. E. von Martens, Arch für Natur., 38, p. 19, 1872. J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., p. 318, 1878; XXXI, p. 393, 1879. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 308, pl. LVII, fig. 2, 1881; Bull. Mus. Comp. Zool., VIII, p. 13, 1880. R. Rathbun, Fishery Industries of U. S., section I, p. 772, 1884. Carl F. Gissler, Amer. Nat., XVIII, p. 225, 1884. B. Ozorio, Jor. Sci. Lisbon, p. 190, 1888.

*Panopeus lacustris*. Desbonne et Schramm, Crustacés de la Guadeloupe, (p. 28), 1867. *Panopeus herbstii* var. *obesus*. S. I. Smith, Proc. Boston Soc. Nat. Hist., XII, p. 278, 1869. Elliott Cones, Proc. Acad. Nat. Sci. Phila. (3), 1, p. 120, 1871. J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., p. 318, 1878. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 309, 1880.

Numerous lots of this species ranging from Rhode Island to Key West, Florida, along the Gulf coast to Louisiana, and along the coast of South America to Brazil, including a number of the West Indian islands, show remarkable variation in form. For our own convenience in the study of the species, we divided them into six varieties according to the prominence and direction of the antero-lateral teeth. In the specimens placed at one extreme of the series, var. G, the teeth are blunt, directed forward, exterior edge rounded or arcuate, the second and third broad at the base. Posterior lobe of coalesced tooth broad and rounded, anterior lobe angular. In the specimens placed at the other extreme of the series, var. B, the antero-lateral teeth are sharp-pointed and project forward and outward. The notches between them are broader than in var. G, making the bases of the teeth narrower. The coalesced tooth in this variety is more deeply cut into two angular

lobes of nearly equal prominence, giving the antero-lateral border more the appearance of being five-toothed. The inner suborbital angle is much sharper in this variety. In var. G the carapace is more convex, the front is less produced, and the contour has a more evenly rounded appearance. In var. B the carapace has a more uneven appearance, the punctures and markings are deeper and coarser. The other characters are variable and cross and recross the convenient division made on the basis of the teeth. As a rule, var. G is proportionately broader than var. B while the latter is more hairy. In var. G the color does not extend quite so far upon the hand, and runs from a black to a brown, while in var. B it runs from a black to a liver color. It is worthy of notice that in some specimens from the West Indies and Brazil the color of the fingers is more or less restricted. In var. B the tooth on the large hand at the base of the movable finger is larger and more conspicuous than in var. G. In no instance is there a groove on the carpus next the articulation with the hand.

We have a great many specimens from Port Royal Island, South Carolina, taken in the banks near high tide mark. The burrows or holes in which these crabs were concealed did not as a rule contain water, while the specimens of *limosus*, taken at the same time, were in burrows partly filled with water. These specimens of *herbstii* are of the var. G or *obesus* type. The chelipeds are spotted with claret brown, and crossed by irregular lines, giving them a reticulate appearance (Pl. XXIII, fig. 11). The chelipeds are more slender than those of the sharp-toothed or B type (Pl. XXIII, fig. 10), which were found on Morgan River, Jericho Creek, and other places at low tide on bunches of oysters. The conclusion reached from the study of the collections from South Carolina is that the varying habit of this crab accounts for its wide differentiation in form. Those living in burrows are the *obesus* type, while the sharper-toothed forms are dredged or found in low water in various hiding places. From our present knowledge, however, we see no way of dividing the species, as our collections show every intermediate gradation.

*Panopeus herbstii* belongs to the section of the genus in which the seventh segment of the sternum in the male is but slightly exposed, and leaves a wide open passage for the verges. Proximal end of second segment much the broader. The fifth pair of feet border broadly on the third abdominal segment. In the anchylosed segment the sides of the third normal segment are nearly straight, slightly swollen in the center. Sides of the fourth normal slightly concave. Proximal end of the fifth normal the broader, sides nearly straight. Penultimate segment with straight and parallel sides. Terminal segment rounded. General outline of last three normal segments not concave but parallel.

Length of carapace in largest specimen, 40 millimetres; width, 62 millimetres.

## RECORD OF SPECIMENS EXAMINED.

Newport, Rhode Island; U. S. Fish Commission (4539).

South Carolina; U. S. Fish Commission, 1890-1891: Winyah Bay (15687); Oyster Bay (15730); Old Man Creek (15741); Bulls Bay (15775); Morgan River (15780); Myrtle Bush Creek (15772); Jericho Creek (15782); Cat Island Creek (15779); Port Royal Island (15768, 15784); near Port Royal (15726); Paris Island, Broad River (15742); mouth of Bull Creek (15722); Calibogue Sound (15737).

Florida: St. Augustine (Yale Univ. Mus.); mouth of Indian River (Yale Univ. Mus.); near Indian Key (15018, 15423); Key Vaccas (14071); Big Pine Key (15014); Key West (9296); South Florida (15415); Garden Key (2077); ? Dry Tortugas (9294); Marco (15017); Oyster Bay (15013); Ferguson's Pass (15419); Punta Rassa (6438); Sarasota Bay (6425); Palma Sola, mouth of Manatee River (6433); Egmont Key (Yale Univ. Mus.); Tampa Bay (15407); near Piney Point (6962); Goodland Point (6985); Boca Ceiga Bay, inner shore of Pine Key (6447); Clearwater (3277); Cedar Keys (6982); Pensacola (3466); West Florida, Kaiser and Martin (6702).

Grand Isle, near New Orleans, Louisiana; G. Kohn (2256).

Bermudas; G. Brown Goode, 1876-1877.

Caribbean Sea: Jamaica (15654); Aspinwall (Yale Univ. Mus.); Sabanilla, U. S. C. (7562); Curaçao (7585); Trinidad (7640).

Maranhão, Brazil; Derby and Wilmot, Hartt Explorations, 1870 (Yale Univ. Mus.).

2. *Panopeus occidentalis* Saussure.

(Plate xx, fig. 3; plate xxiii, fig. 14.)

*Panopeus occidentalis*. H. de Saussure, Rev. et Mag. de Zool. (2), 9, p. 502, 1857; Mém. Soc. Phys. Genève, xiv, p. 431, pl. 1, fig. 6, 1857. W. S[timpson], Amer. Jour. Sci. (2), 27, p. 446, 1859; S. I. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 279, 1869. E. v. Martens, Arch. für Natur., 38, p. 90, 1872. A. M. Edwards, Miss. Sci. au Mexique, pt. 5, 1, p. 310, 1880; Bull. Mus. Comp. Zool., viii, p. 13, 1880.

Carapace convex in both directions, covered with minute granules interspersed with punctures of much larger size. In some specimens there are a few transverse lines composed of larger granules. Regions fairly distinct, depressions slight, and occasionally in part obliterated. Antero-lateral teeth slightly elevated, anterior margins truncate. The three posterior teeth are pointed. First tooth separated from the post-ocular tooth by a rather deep sinus, which, however, does not divide the coalesced tooth to its base.

Front produced, thin, slightly depressed, with a median fissure, each lobe slightly emarginate, giving the front a somewhat four-lobed appearance. Median lobes more produced; lateral lobes faint.

Space between the two fissures of the upper orbital margin slightly rounded, interrupting the regular curve of the orbit. External hiatus widely V-shaped and deep. The inner suborbital angle forms a prominent tooth. A rather deep sinus divides this from the lobe which reaches to the external fissure. Lower orbital margin produced.

Abdomen of the male wider than in *herbstii*, outline concave, penultimate segment widest at its distal end. Coxæ of fifth pair of feet in broad contact with third abdominal segment. Seventh segment of sternum shows but little.

The marginal depression on the carpus near the articulation with the hand is wide and deep. In some specimens the carpus is finely granulate; in others the granules are thrown up in slight rugæ. The hand varies in much the same way: in some specimens finely granulate; in others, thrown up in rugæ as in the carpus. In the latter case the hand is always much smoother than the carpus in the same specimen. Fingers brown or horn color, shading to clear white at the tips. There is a large tooth at the base of the dactyl of the large hand. There is also a more or less prominent tooth on the large hand at the base of the dactyl. The color on the immovable finger does not extend beyond the line of color on the movable finger; while in *herbstii* it usually extends considerably beyond. Meros of ambulatory feet more slender and a little longer than in specimens of *herbstii* of the same size. Ambulatory feet slightly hairy.

The most of our specimens are readily separated from *herbstii* by the color, which, in alcohol, is very much lighter, with a pinkish tinge on the chelipeds. This separation is confirmed by the prominent depression on the carpus near the articulation with the hand, of which there exists scarcely a trace in *herbstii*.

Length of carapace in large specimen, 20 millimetres; width, 27.5 millimetres.

#### RECORD OF SPECIMENS EXAMINED.

South Carolina; U. S. Fish Commission, 1891: Calibogue Sound (15713, 15716).

Florida: Carysfort Reef (9297); Indian Key (15418); No Name Key (15015); Key West (14445, 15424); South Florida (3464); Marco (15427); Goodland Point (15426); Boca Ceiga Bay, inner shore of Pine Key (15425).

Caribbean Sea; U. S. Fish Commission, 1834: Jamaica (7678); Old Providence (9135); Sabanilla, U. S. C. (15656); Curaçao (7588); Trinidad (15657).

#### 3. *Panopeus areolatus*, sp. nov.

(Plate XXI, fig. 3.)

This species in its shape and proportion is most nearly related to *herbstii*, in its antero-lateral teeth to *angustifrons* and *bermudensis*. Carapace more flattened than in *herbstii*, antero-lateral teeth slightly upturned, the posterior three much more triangular than in *herbstii*. Areolations of the carapace very distinct in the young as well as the adult. In the younger forms the granules of the anterior portion are arranged in more marked lines than in the older.

Front narrower and slightly more produced in the middle than in *herbstii*. External lobes well marked and slightly produced; front thickened, readily distinguishing this species from *herbstii*; upper and lower edges granulate; the intermediate space is occupied by large granules and by some irregular spaces without granules.

Coalesced tooth unevenly divided into two parts by a sulcus which cuts it about one-third the way to the base. Posterior portion larger and rounded, anterior pointed. Anterior margin of second tooth trun-



cate. Third tooth much the largest, broadly triangular, its anterior margin nearly perpendicular to the median line of the carapace. Fourth tooth triangular, anterior margin sloping backwards to the tip.

External hiatus of the orbit broad and rounded at the base, in the smaller specimens more V-shaped. Sub-hepatic tubercle present.

Seventh segment of the sternum in the male very slightly if at all exposed. Coxæ of fifth pair of feet in contact with third abdominal segment. In the anchylosed segment the outline of the third normal segment is rather angular. Outline of the fourth normal concave and of the fifth normal convex. Terminal segment somewhat triangular, rounded at the tip. Penultimate segment widest at its distal end, while in *herbstii* the segment is of the same width throughout its length. The very different arrangement of the second and third segments distinguishes this species from *bermudensis*. A comparison of the appendages of the male abdomen shows it to be widely separated from *herbstii*.

Chelipeds very much like those of *herbstii*. Lower margin of large hand a little straighter, and in some specimens convex. Hand a little deeper than in *herbstii*, movable finger slender and strongly arched, making a conspicuous gape in all the specimens from the largest to the smallest. Cylindrical tooth at the base of the movable finger long. Tooth on the manus less conspicuous than in *herbstii*. Dactyls of ambulatory feet hairy. There are a few hairs on the propodal joints.

Length of carapace in large specimen, 21.5 millimetres; width, 27.5 millimetres.

#### RECORD OF SPECIMENS EXAMINED.

Caribbean Sea: Jamaica (7783); St. Thomas (Yale Univ. Mus.); Aspinwall (Yale Univ. Mus.); Sabanilla, U. S. C. (15646).

Brazil; Hartt Explorations: Maranhão; Plataforma, Bahia; Bom Fim, Bahia.

#### 4. *Panopeus validus* Smith.

(Plate XIX, fig. 3; plate XXIII, fig. 13.)

*Panopeus validus*. S. I. Smith, Proc. Boston Soc. Nat. Hist., XII, p. 278, 1869; Ann. Rept. Peabody Acad. Sci., 3, p. 89, 1870. W. N. Lockington, Proc. Cal. Acad. Sci., VII, p. 102, 1876. J. S. Kingsley, Proc. Boston Soc. Nat. Hist., XX, p. 152, 1879.

"*? Panopeus chilensis*." A. M. Edwards, Miss. Sci. au Mexique, pt. 5, 1, p. 315, 1880.

Front divided by a closed fissure, the outer end of which rounds out into the lobes. In some specimens the posterior lobe of the coalesced tooth is produced forward to the same line as the anterior. Posterior lobe larger and more conspicuous than the anterior. Male abdomen much as in *herbstii*. Seventh segment of sternum very slightly exposed.

Length of carapace in large specimen, 34 millimetres; width, 48 millimetres.

The specimens which we have examined are distinct from *P. chilensis* as figured by Edwards and Lucas in d'Orbigny's Voy. l'Amér. Mérid., 1843, pl. VIII, fig. 2, and with our present knowledge we do not feel warranted in uniting the two species.

## RECORD OF SPECIMENS EXAMINED.

Acajutla, San Salvador (Yale Univ. Mus.).  
Bay of Panama (Yale Univ. Mus.).  
Locality unknown (13930).

5. *Panopeus texanus* Stimpson.

(Plate XXII, fig. 5; plate XXIII, fig. 9.)

*Panopeus texanus*. W. Stimpson Ann. Lyc. Nat. Hist., VII, p. 55, 1859. J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., XXXI, p. 394, 1879 (partim). A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 312, pl. LVIII, fig. 4, 1880 (partim).

Carapace very convex in both directions, widest at the posterior teeth, and minutely pubescent, especially in the females. Front slightly produced and rounded. Coalesced tooth with a very shallow sinus. Second and third teeth sharp, and pointing forward and upward. Posterior tooth short and sharp, the tip directed forward. Male abdomen very broad, lateral outline markedly concave, terminal segment much flattened.

Chelipeds smooth and glabrous. The movable finger is a light horn color. The immovable finger is white in the male, the color extending to the hand and terminating in a very distinct line, which begins at the base of the finger at the gape and rounds backward to the lower margin. In the females the color is a little darker. There is no large tooth or tubercle at the base of the dactyl or on the anterior outer margin of the manus. Ambulatory feet long and slender.

Length of carapace in large specimen, 17 millimetres; width, 22.5 millimetres.

## RECORD OF SPECIMENS EXAMINED.

Florida: Mouth of Indian River (Yale Univ. Mus.); Marco (15384); Punta Rassa (6653, 14082); Charlotte Harbor (14089); Sarasota Bay (6426, 6975); Palma Sola, mouth of Manatee River (15383); Egmont Key (Yale Univ. Mus.); Tampa Bay (15385); Goodland Point (15631); Boca Ceiga Bay, inner shore of Pine Key (15382); Orange Bluff, Clearwater Harbor (6968); Cedar Keys (6415, 15386).

6. *Panopeus sayi* Smith.

(Plate XXII, fig. 4; plate XXIII, figs. 7 and 8.)

*Cancer panope* (pars). Thomas Say, Jour. Acad. Nat. Sci. Phila., I, pp. 58, 447, 1817.

*Panopeus sayi*. S. I. Smith, Proc. Boston Soc. Nat. Hist., XII, p. 284, 1869; Rept. Commr. of Fisheries for 1871 and 1872 (1874), pp. 547, 312; Trans. Conn. Acad., V, p. 37, 1879. J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., p. 319, 1878. A. E. Verrill, Check-List of Marine Invert., p. 1, 1879. R. Rathbun, Proc. U. S. Nat. Mus., 3, p. 119, 1880; Fishery Industries of U. S., section I, p. 772, 1884. Walter Faxon, Bull. Mus. Comp. Zool., 6, p. 165, pl. II, 1880. E. A. Birge, Studies Biol. Lab. Johns Hopkins Univ., II, No. 4, pp. 411-426, pls. XXX-XXXIII, 1883. Carl F. Gissler, Amer. Nat., XVIII, p. 225, 1884.

*Panopeus texanus*. J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., XXXI, p. 394, 1879 (partim). A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 312, pl. LVIII, fig. 4, 1880 (partim).

*Panopeus sayi* is so closely related to *texanus* that any description is necessarily comparative. The frontal margin of *sayi* is depressed, while that of *texanus* is horizontal or nearly so. In specimens of equal size the abdomen is narrower at the terminal segment in *sayi*, and the constriction at the articulation of the anchylosed and penultimate segments is less in *sayi*. With a little experience one could separate the two species on the character of the surface of the chelipeds. In many specimens of *sayi* the chelipeds are marked with irregular lines of color corresponding to very small oblong depressions between which the surface is minutely granulated and scattered with punctures. The chelipeds of *texanus* are covered with very minute granules and with thinly scattered punctures. To the naked eye the surface appears glabrous. In *sayi* the color of the fingers in the male ranges from black to horn color, and runs up on the hand both inside and out to a variable extent (Pl. XXIII, figs. 7 and 8). In the females the fingers are horn color, which is often restricted, much as in *texanus*, but in this species the females can readily be distinguished by the antero-lateral teeth, which are sharper and more produced. The ambulatory feet are relatively much shorter in *sayi* than in *texanus*. This is most noticeable in comparing the dactyls of the fourth and fifth pairs of feet (Pl. XXII, figs. 4 and 5).

Length of carapace in large specimen, 17 millimetres; width, 22.5 millimetres.

After a critical examination of over five hundred specimens of *sayi* and over two hundred and fifty of *texanus* we regard the two species as altogether distinct, as they can be separated by several different characters. On the coast of South Carolina, a region intermediate between Cape Cod, the well-known habitat of *sayi*, and the Florida coast, where all our specimens of *texanus* were obtained, large numbers of *Panopeus* have recently been collected, none of which present any gradations between *sayi* and *texanus*, but all are identical with the northern form.

#### RECORD OF SPECIMENS EXAMINED.

Massachusetts: Wellfleet (3001); Provincetown (3005, 3827); off Falmouth (13843); Vineyard Sound, low water to 9 fathoms; Wood's Holl (3214, 15662); Buzzard's Bay, 5 to 8 fathoms; Mattapoisett Harbor (5782).

Long Island Sound, U. S. Fish Commission: Gardiner's Bay (15752); New Haven Harbor, on oyster beds (4162); off Milford, Stratford, and Bridgeport, on oyster beds.

New Jersey: Beesley's Point (Yale Univ. Mus.).

Virginia: Mouth of Indian River, Chesapeake Bay, on iron buoy (15618); York River, Chesapeake Bay, on wooden buoy (13847); Hampton Roads, 12 fathoms (12453).

North Carolina: Fort Macon (Yale Univ. Mus.).

South Carolina, U. S. Fish Commission, 1890-1891: Winyah Bay (15689); Clam-bank Creek (15703); Bulls Bay (15777); Coosaw River (15771); Myrtle Bush Creek (15769); Jericho Creek (15783); near Port Royal (15729); one mile inside of May River (15731); west end of Skull Creek (15738); Bull Creek (15721, 15734); Calibogue Sound (15773).

7. *Panopeus packardii* Kingsley.

(Plate XXII, fig. 1; plate XXIII, fig. 6.)

*Panopeus packardii*. J. S. Kingsley, Proc. Boston Soc. Nat. Hist., xx, p. 152, 1879; Proc. Acad. Nat. Sci. Phila., xxxi, p. 394, 1879. E. J. Miers, Challenger Rept., Zool., xvii, p. 129, 1886.

Carapace much swollen. Front slightly bilobed, produced, and very much rounded in an even curve with the coalesced post-ocular and first tooth. The swollen carapace and produced front give it a strong resemblance to *texanus*.

Antero-lateral teeth sharper and more produced than in *texanus*. Post-ocular tooth so far coalesced with the first antero-lateral tooth as to show a scarcely perceptible emargination. The second and fourth teeth point at right angles to each other, while the third points in an intermediate direction.

Seventh segment of male sternum not at all exposed. In the anchylosed segment the third normal segment is rather narrow, its margin is rounded, and it borders on the coxæ only at the articulation. Outline of fourth normal segment concave, of the fifth more nearly straight. Penultimate short. Terminal segment short and rounded.

Fingers of the chelipeds black with white tips, varying in some specimens to light brown with white tips. The color runs up on the hand at the lower margin. Movable finger of large cheliped has a large tooth at its base. Tooth on the manus at the base of the movable finger often not well developed. Now and then an individual will be found in which both chelipeds have the character of the usual small cheliped, with no large tooth on the dactyl and no tooth on the hand at the base of the dactyl. These variations do not connect this species with any other when all the characters are considered. Carpal tooth sharp.

The antero-lateral teeth, the more rounding front, the very different shape of the abdomen, and the tooth at the base of the finger separate this species from *texanus* and *sayi*.

Length of carapace in large specimen, 13 millimetres; width, 18 millimetres.

## RECORD OF SPECIMENS EXAMINED.

Florida: Cards Sound (15225); Key Largo (15392); No Name Key (13546); Key West (15390, 15395); Marco (15633); Punta Rasa (15394); Charlotte Harbor (15389, 15393); Sarasota Bay (6430); Boca Ceiga Bay, inner shore of Pine Key (15396); Orange Bluff, Clearwater Harbor (15391); off northwest end St. Martin's Reef (13042); Cedar Keys (15397); Sea Horse Key (13051).

8. *Panopeus depressus* Smith.

(Plate xx, fig. 5; plate xxiii, figs. 4 and 5.)

*Panopeus depressus*. S. I. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 283, 1869; Rept. U. S. Commr. of Fisheries for 1871 and 1872 (1874), pp. 547, 312, pl. i, fig. 3; Trans. Conn. Acad., v, p. 37, 1879. J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., p. 313, 1878; xxxi, p. 394, 1879. P. R. Uhler, Sci. Results, Chesapeake Zool. Lab. for 1878 (1879), p. 25. A. E. Verrill, Check-List of Marine Invert., p. 1, 1879. R. Rathbun, Proc. U. S. Nat. Mus., 3, p. 119, 1880; Fishery Industries of U. S., section 1, p. 772, pl. 269, fig. 3, 1884. J. H. Emerton, Life on the Seashore, p. 40, fig. 42, 1880. Carl F. Gissler, Amer. Nat., xviii, p. 225, 1884.

*Eurypanopeus depressus*. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, t. p. 330, pl. LIX, fig. 2, 1880.

*Panopeus depressus* is readily distinguished from *dissimilis* by having the male abdomen composed of five segments instead of six. It is distinguished from all other species by the flattened carapace with transverse granulate rugæ, the nearly straight front, and the prominent semi-spoon-shaped fingers of the small hand, and occasionally of the large, in connection with the black or dark brown color of the fingers, the color running up on the hand far behind the gape of the claw.

Margin of second segment of male abdomen concave. Coxæ of fifth pair of feet in contact with third segment.

Length of carapace in large specimen, 14 millimetres; width, 19 millimetres.

## RECORD OF SPECIMENS EXAMINED.

Vineyard Sound, Massachusetts; U. S. Fish Commission (14799).

Beesley's Point, New Jersey (Yale Univ. Mus.).

Virginia: Smith's Creek, Potomac River, on wooden buoy (13845); mouth of Indian Creek, on iron buoy (13929); Chesapeake Bay, 9½ to 20 fathoms (13793); Pamunkey River, on iron buoy (13848); York River, on wooden buoy (15403).

South Carolina: U. S. Fish Commission: Winyah Bay (15683, 15688); near inlet Jones Creek (15685); upper mouth Clambank Creek (15702); Bulls Bay (15706); Charleston Harbor (4065); Morgan River (15781); Jericho Creek (15785); near Port Royal (15727).

Florida: Mouth of Indian River (Yale Univ. Mus.); Cape Florida (13899); Garden Key (2292); Oyster Bay (6990); Ferguson's Pass, Oyster Bay (6981); Punta Rassa (6665); Sarasota Bay (15400); Palma Sola, mouth of Manatee River (15401); Egmont Key (Yale Univ. Mus.); Tampa Bay, near Piney Point (15399); Goodland Point (15398); Clearwater (3278); Cedar Keys (6418).

9. *Panopeus dissimilis*, sp. nov.

(Plate xx, fig. 4; plate xxiii, fig. 1.)

Carapace convex in both directions, crossed by lines of granules very much as in *depressus*. Gastric regions little elevated.

Front horizontal, little produced, nearly straight, not at all four-lobed; median notch slight; edge thin, studded with fine granules.

Orbit with two fissures above, the interspace a little produced; upper and lower margins set with a single row of granules, which are continued along the margin of the antero-lateral teeth.

Anterior portion of coalesced tooth conical, short; posterior portion

rounded and long. Anterior edge of second tooth straight, the point hooked forward, posterior edge rounding. Anterior edge of third tooth curved forward to a point. Posterior edge long and not so much rounded as that of the second tooth. Last tooth small, sharp, point projecting forward. In general appearance the antero-lateral teeth are much like those of *depressus*, but cut much deeper and more strongly hooked forward.

External hiatus of orbit a deep-cut triangular notch. Subhepatic and subbranchial regions closely set with flattened depressed granules. As in *depressus*, the subhepatic tubercle is wanting.

Sides of second segment of male abdomen concave. Coxæ of fifth pair of feet broadly in contact with third segment of abdomen. Third segment entirely free, its sides nearly straight. Fourth and fifth normal segments anchylosed, their sides concave, the fourth broadest at its proximal end. Penultimate segment short, its sides slightly concave. Terminal segment rounded.

Chelipeds very unequal. Carpus of the larger cheliped finely granulated on its inner and upper portions, slightly rugose on its outer portion. Carpus of the smaller cheliped more coarsely rugose and granulate than that of the larger. Carpal tooth very sharp, shaped like that of *depressus*. Larger manus minutely granulate, swollen, deep. Fingers very short, gaping, unarmed. Smaller hand coarsely granulated, with one or two longitudinal lines on the exterior surface, and with a double crest above, the intervening sulcus deeper than usual in the genus. A line of granules extends along the upper margin of the movable finger nearly to the tip. Fingers partially spoon-shaped, as in *depressus*; impressed lines deep. Ambulatory feet like those of *depressus*, except that they are set with thinly scattered hairs.

Notwithstanding the fact that, in the twenty males examined, the abdomen has six segments, we place this species in the genus *Panopeus*, as it has the character of the external hiatus of the orbit, the teeth of the antero-lateral margin are those of *Panopeus*, the appendages of the male abdomen are characteristic of many species of the genus and not very unlike those of *depressus*. The whole make-up is so closely like that of *depressus* that it takes a second look to distinguish it.

Length of carapace in large specimen, 12 millimetres; width, 17 millimetres.

#### RECORD OF SPECIMENS EXAMINED.

Trinidad; U. S. Fish Commission, 1884 (15640).

Vigia, Brazil; Derby and Powers, Hartt Explorations, 1870 (Yale Univ. Mus.)

#### 10. *Panopeus transversus* Stimpson.

(Plate xxii, fig. 2; plate xxiv, fig. 9.)

*Panopeus transversus*. W. Stimpson, Ann. Lyc. Nat. Hist., vii, p. 210, 1860. S. I. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 282, 1869; Trans. Conn. Acad., ii, p. 4, 1869; Ann. Rept. Peabody Acad. Sci., 3, p. 89, 1870.

*Eurypanopeus transversus*. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, i, p. 319, pl. lxx, fig. 1, 1880.

It is distinguished from all other species which we have seen, by the convex carapace in connection with the lobate teeth and the contact of the coxæ of the fifth pair of feet with the third abdominal segment.

The specimens examined are from Acajutla, San Salvador, F. H. Bradley (Yale Univ. Mus.).

Length of carapace in large specimen, 12 millimetres; width, 18 millimetres

11. *Panopeus ovatus*, sp. nov.

(Plate XXIV, fig. 8.)

We have designated under this name nine small specimens of *Panopeus* from Concepcion Bay, Gulf of California, collected by the U. S. Fish Commission steamer *Albatross*, March, 1889 (15786). Carapace sub-oval, areolations fairly distinct, not protuberant. Anterior and antero-lateral portions of carapace granulated, the granules not evenly scattered over the surface, but thrown into bunches and rugæ. Lines from the notches between the antero-lateral teeth run up on the carapace, that from the second separating the hepatic and branchial regions and ending in a rounded depression. Groove between the cardiac and mesogastric regions conspicuous.

Front divided by a very slight notch, beveled, the beveled edge covered with granules. Wide median lobes very little produced, slightly rounded. Lateral lobes projecting as small blunt teeth.

The regular curve of the orbit is broken by two fissures, the space between which is straight or often a little produced.

Margin of coalesced tooth either straight or a little convex. Outline of the next two teeth nearly straight. Last tooth small, triangular and obtuse. The notches between the antero-lateral teeth are deeper and more widely gaping than in *transversus*.

Seventh sternal segment in the male entirely covered by second segment of abdomen. Outline of abdomen straight or very slightly concave. Terminal segment rounded.

Carpus granulate, carpal groove very short. Inner angle of the carpus not produced, there being but a trace of a tooth. Fingers arched and hooked at the tips, leaving a slight gape. Dactyl of the larger cheliped armed with a very small tooth near its base. Fingers of small hand marked with longitudinal impressed striæ. Prehensile edges armed with small irregular teeth.

This species is closely allied to *transversus*, but is easily distinguished by the areolated, granulated, and more flattened carapace, and by the wider notches between the teeth of the antero-lateral margin.

Length of carapace in large specimen, 8 millimetres; width, 12 millimetres.

12. *Panopeus parvulus* (Fabricius).

(Plate XXI, fig. 1; plate XXIII, figs. 2 and 3.)

*Cancer parvulus*. Fabricius, *Entomologia Systematica*, II, p. 451, 1793.*Xantho parvulus*. Milne Edwards, *Hist. Nat. des Crust.*, 1, p. 395, 1834. J. D. Dana, *Crust. U. S. Ex. Ex.*, 1, p. 170, 1852.† *Panopeus politus*. S. I. Smith, *Proc. Boston Soc. Nat. Hist.*, XII, p. 282, 1869; *Trans. Conn. Acad.*, II, pp. 3, 34, pl. 1, fig. 4, 1869; *Amer. Jour. Sci.* (2), 48, p. 389, 1869.*Eurypanopeus parvulus*. A. Milne Edwards, *Miss. Sci. au Mexique*, pt. 5, I, p. 322, pl. LIX, fig. 5, 1880.† *Eurypanopeus politus*. A. Milne Edwards, *Loc. cit.*, p. 323.

We have twenty-six specimens from Florida, West Indies, and Brazil, which correspond very well with A. Milne Edwards's description and figure of *Eurypanopeus parvulus*. They are also well described by S. I. Smith under the name of *Panopeus politus*.

Seventh segment of male sternum not exposed. Anchylosed segment concave throughout its length, except that the proximal end is angular. Penultimate segment widest at its distal end, outline concave. Terminal segment short and rounded.

Length of carapace in large specimen, 12 millimetres; width, 18 millimetres.

## RECORD OF SPECIMENS EXAMINED.

Key West, Florida; Dr. H. Allen (Yale Univ. Mus.); H. Hemphill, 1885 (15787).

San Domingo; W. M. Gabb, 1878 (3202).

Sabanilla, U. S. C.; U. S. Fish Commission, 1884 (15788).

Trinidad; U. S. Fish Commission, 1884 (15658).

Rio Vermelho, Bahia, Brazil; R. Rathbun, Hartt Explorations, 1875-76.

13. *Panopeus planus* Smith.

(Plate XXIV, figs. 10 and 11.)

*Panopeus planus*. S. I. Smith, *Proc. Boston Soc. Nat. Hist.*, XII, p. 283, 1869. W. N. Lockington, *Proc. Cal. Acad. Sci.*, VII, p. 102, 1876.*Eurypanopeus planus*. A. Milne Edwards, *Miss. Sci. au Mexique*, pt. 5, I, p. 321, pl. LIX, fig. 4, 1880.

Carapace slightly convex longitudinally, nearly straight transversely. Areolations well defined. Anterior margin coarsely granulate, the granules thrown up in transverse lines or rugæ on the carapace. Posterior and central portions of carapace nearly smooth or glabrous to the naked eye. From the median notch of the front a deep groove extends back to the mesogastric region. There is also a deep groove running from the orbit back to the cardiac region, inclosing the gastric regions. Between the second and third antero-lateral teeth a deep groove runs back between the hepatic and the branchial regions and ends abruptly in a shallow pit. Between the last two teeth a groove of the same character runs back, but not so far. The groove between the coalesced and the second tooth ends abruptly at the base of the teeth.



External lobes of the front produced and prominent. Median lobes divided by a V-shaped notch, and produced but very little beyond the lateral lobes. Edge of the front thickened and granulate; granules rather large.

Coalesced tooth very wide, with nearly straight margin. Direction of the margin almost transverse; angle of the orbit very little produced. Third tooth a wide lobe, corners slightly rounded, the edge taking a direction nearly perpendicular to the coalesced tooth. Second tooth similar; direction of the margin intermediate between those of the first and third. Posterior tooth pointed; anterior edge very short and nearly perpendicular to the median line, posterior margin continuous with the postero-lateral margin of the carapace.

Subhepatic region very coarsely granulate, the granules extending up on the lower orbit. Tubercle prominent and spreading. Inner lower angle of the orbit triangular, much produced, and separated from the outer lobe by a wide deep sinus. External hiatus wide and rounded at the bottom.

Seventh segment of male sternum slightly exposed in some specimens. Outline of proximal end of anchylosed segment angular. Terminal segment rounded.

Carpus of the chelipeds broad, smooth to the eye, but showing fine granules under the lens. There is a very depressed spine at the inner angle, and no carpal groove. Hands large, thin, deep, pitted, and microscopically granulate. Dactyl slender, curved, in the large hand having a small cylindrical basal tooth. Tubercle sometimes present on the manus, near the articulation with the dactyl. Immovable finger triangular, color running up on the palm and behind the gape, much as in *depressus*. Fingers hooked at the tips.

Length of carapace in large specimen, 16.5 millimetres; width, 26.5 millimetres.

The specimens examined are from the Bay of Panama, F. H. Bradley (Yale Univ. Mus.).

#### 14. *Panopeus planissimus* Stimpson.

(Plate XXI, fig. 5; plate XXIV, figs. 1 and 2.)

*Xantho planissima*. W. Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, p. 205, 1860.

*Panopeus planissimus*. W. Stimpson, Ann. Lyc. Nat. Hist. N. Y., X, p. 108, 1871.

*Eurypanopeus planissimus*. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 322, 1880.

Carapace flat; posterior two-thirds smooth and glabrous; anterior finely granulate and slightly rugose.

Median lobes of front separated by a V-shaped notch, produced and somewhat rounded. Lateral lobes little produced, rounded. Edge of front thick and finely granulate, in some of the smaller dried specimens appearing double.

Coalesced tooth broadly emarginate; at the inner angle of the orbit

produced and angular; posterior portion rounded. Second tooth an oblong lobe. Third tooth pointed; posterior margin about twice as long as the anterior. Fourth tooth short; posterior margin continuous with the postero-lateral margin of the carapace. Granules on the margin of the teeth very small and inconspicuous.

Subhepatic regions finely granulate. Tubercle prominent.

Seventh segment of male sternum not exposed. General outline of distal half of abdomen nearly straight. Proximal end of anchylosed segment angular.

Carpus broad. Tooth at the inner angle very small. Groove at the outer margin deep and channeled, and a second groove at right angles to the first runs back on the carpus, forming two tubercles on a line with the upper margin of the hand. Hands rather thin and deep. Dactyl of the large hand very slender, with a white, cylindrical tooth at its base. Tubercle on the manus at the base of the dactyl. Fingers brown, lighter at the tips, color running up on the hand in the larger specimens.

The carpal groove in connection with the flat carapace, the antero-lateral teeth without prominent granules, and the emarginate post-ocular tooth, distinguishes this species readily from *planus*.

Length of carapace in large specimen, 8.5 millimetres; width, 12 millimetres.

#### RECORD OF SPECIMENS EXAMINED.

La Paz Harbor, Lower California; L. Belding (4629); U. S. Fish Commission, 1889 (16025).

#### 15. *Panopeus serratus* Saussure.

(Plate xxiv, figs. 3 and 4.)

*Panopeus serratus*. H. de Saussure, Rev. et Mag. de Zool. (2), 9, p. 502, 1857; Mém. Soc. Phys. Genève, xiv, p. 432, pl. 1, fig. 7, 1857. W. S[timpson], Amer. Jour. Sci. (2), 27, p. 446, 1859. S. I. Smith, Proc. Boston Soc. Nat. Hist., xii, p. 280, 1869. E. v. Martens, Arch. für Natur., 38, p. 90, 1872. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, 1, p. 311, 1880; Bull. Mus. Comp. Zool., viii, p. 13, 1880. *Panopeus herbstii* var. *serratus*. E. J. Miers, Challenger Rept., Zool., xvii, p. 129, 18-6.

To this species have been doubtfully referred two small specimens, a male from No Name Key, Florida (15664), and a female from Dry Tortugas (?), Florida (15663).

Carapace convex, with rather well-marked areolets. Front very little produced, nearly straight, thin, with a line of granules on the edge, giving it a minutely denticulate appearance. Antero-lateral teeth sharp, the posterior three hooked forward. Sinus between the external angle of the orbit and the first tooth deep. External hiatus of orbit a large V-shaped opening. Subhepatic tubercle small but well defined. Abdomen much like that of *occidentalis*. Seventh segment of sternum exposed. Coxæ of fifth pair of feet in contact with third abdominal segment.

Carpus and hand coarsely and densely granulate, rugose above. Carpal spine sharp, pointing forward. Fingers not gaping. Large tooth at the base of the dactyl on the large hand, and a tooth on the hand at the base of the dactyl.

Length of carapace, 7 millimetres; width, 8 millimetres.

#### 16. *Panopeus harttii* Smith.

(Plate xx, fig. 1; plate xxiv, fig. 5.)

*Panopeus Harttii*. S. I. Smith, Proc. Boston Soc. Nat. Hist., XII, p. 280, 1869; Trans. Conn. Acad., II, pp. 5, 34, pl. I, fig. 5, 1869; Amer. Jour. Sci. (2), 43, p. 329, 1869. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 314, 1890.

Second segment of male abdomen broadest at its proximal end; sides deeply concave. Seventh segment of sternum well exposed. Coxæ of fifth pair of feet in contact with third segment of abdomen. For a large portion of its length the outline of the abdomen is nearly straight.

Length of carapace in large specimen, 15 millimetres; width, 22 millimetres.

A young female from St. Thomas is doubtfully referred to this species.

#### RECORD OF SPECIMENS EXAMINED.

Florida: Indian Key; H. Hemphill (15647).

St. Thomas; Hartt Explorations, 1870 (Yale Univ. Mus.).

Brazil; Hartt Explorations, 1875-1876: Pernambuco; Rio Formosa, Pernambuco; Plataforma, Bahia; Abrolhos Islands.

#### 17. *Panopeus wurdemannii* Gibbes.

(Plate xxiv, figs. 6 and 7.)

*Panopeus Wurdemannii*. Lewis R. Gibbes, Proc. Amer. Assoc. Adv. Sci., 3, p. 176, 1850. Joseph Leidy, Jour. Acad. Nat. Sci. Phila. (2), III, p. 17, 1855.

There is in the National Museum a specimen labeled "*Panopeus Wurdemannii*." It agrees with Gibbes's description, the principal characters of which are as follows:

It most nearly resembles *P. Herbstii*. The anterior edge of the front is marked by a groove whose borders are formed by finely granulated ridges. The surface of shell also is marked by a few distinct transverse ridges; the finger and thumb are white.

We have found several other specimens which agree with the first, and still others which agree in everything but the white fingers.

General appearance much like *herbstii*, but the coalesced tooth has the sinus more shallow and the rounded posterior portion longer; no conspicuous pubescence.

A character common to all the specimens is a short second segment of the male abdomen, exposing broadly the seventh segment of the sternum. Proximal end of third abdominal segment but little produced laterally; outline rounded.

In some specimens the condyle of the coxæ of the fifth pair of feet

separates the sixth and seventh segments of the sternum and comes in contact with the anchylosed segment of the abdomen. In other specimens the coxæ are entirely separated from the anchylosed segment.

Carpi and hands coarsely granulate, not rugose. Carpal groove well marked. Both hands have the double crest above. Fingers of larger specimens white, in the smaller ranging from very dark to very light, with nearly the distal half white. Tooth on the dactyl sometimes wanting.

In some instances the ambulatory feet are banded with color, and there is a large purple spot on the gastric and a smaller one on the cardiac region.

Two specimens collected by Mr. R. Rathbun at Bom Fim, Bahia, Brazil, have been doubtfully referred to this species. The carpi and hands are slightly rugose, but the general appearance is that of *wurdemanni*.

Length of carapace, 5.5 millimetres; width, 7 millimetres.

#### RECORD OF SPECIMENS EXAMINED.

Florida: Garden Key, Dry Tortugas (3217); Marco (15667); Sarasota Bay (15666); Goodland Point (15665).

Bom Fim, Bahia, Brazil; R. Rathbun, Hartt Explorations, 1875-1876.

#### 18. *Panopeus angustifrons*, sp. nov.

(Plate XXII, fig. 3; plate XXIV, fig. 18.)

Carapace convex; areolations fairly well marked. In many specimens a slight ridge runs from the base of the last antero-lateral tooth to the gastric lobes.

Front very narrow, much produced, divided into four lobes, the middle lobes separated by a prominent V-shaped notch. From the notch the margin curves backward to the lateral lobes which are small and inconspicuous.

Orbits with two fissures above; the space between the fissures rounded and produced.

Antero-lateral edge thin and upturned. In the coalesced tooth the sinus is shallower in the adult than in the young; the orbital angle is sharp, posterior angle rounded. Second tooth broad; anterior edge running nearly perpendicular to the median line of the carapace. Posterior edge much longer than the anterior and cut obliquely backwards and outwards from the tip. In the third tooth the anterior and posterior margins are more nearly equal; the posterior, however, a little the longer. Posterior tooth shorter, sharper, and less prominent than the others. The teeth are separated by narrow deep cuts.

Inner lower angle of the orbit pointed, conical, and produced much beyond the inner upper angle. External fissure usually deep, closed at the bottom, widely spreading at the opening. Hepatic tubercle wanting. The pterygostomian region is much swollen. The maxillipeds are quadrate, their external anterior angles rounded.

In the male abdomen the third, fourth, and fifth normal segments are anchylosed, but between these segments on each side there is a short deep groove, making a superficial division (Pl. xxiv, fig. 18). Third normal segment nearly as wide as the first, its sides very much rounded, while the sides of the fourth and fifth normal segments are concave. Seventh segment of the sternum much exposed, cutting off the coxæ of the fifth pair of feet from contact with the third abdominal segment, and the male verges pass through a closed, or in some specimens a nearly closed, canal.

Meros of the chelipeds short and deep. On its upper margin is a short tooth pointing forwards; behind this tooth the margin is ordinarily straight for some distance, this straight part ending sometimes in an obtuse angle, sometimes in a small tooth. Carpal groove deep. Tooth at the inner angle of the carpus subcylindrical and obtuse. In most specimens there is also a flattened tubercle on the carpus in a line with the superior margin of the hand. Large hand smooth, deep and swollen; fingers conspicuously gaping, with a prominent cylindrical tooth near the base of the dactyl; also a tooth on the hand at the base of the dactyl. Fingers of each hand strongly hooked at the tips. The color of the fingers varies from black to dark brown, does not extend up on the hand, and is lighter at the tips. Ambulatory feet slender, dactyls long and hairy.

Length of carapace in large specimen, 19.5 millimetres; width, 28 millimetres.

#### RECORD OF SPECIMENS EXAMINED.

Vineyard Sound, Massachusetts (15639).

Buzzard's Bay, 8 fathoms (15638).

Narragansett Bay, Rhode Island, 12½ fathoms (5769).

Long Island Sound on oyster grounds; U. S. Fish Commission, 1890: Off Milford, Stratford, Bridgeport, and Norwalk, Connecticut.

Hampton Roads, Virginia, 11 to 12 fathoms (15611).

Fort Macon, North Carolina (Yale Univ. Mus.).

South Carolina; U. S. Fish Commission, 1890-1891: Near Port Royal (15728); one mile inside of May River (15732); west end of Skull Creek (15739); mouth of Bull Creek (15723); Calibogue Sound (15774).

Florida: Marco (15642); Punta Rassa (15643); Charlotte Harbor (15644); Sarasota Bay (15645).

Vigia, Brazil; Derby and Powers, Hartt Explorations, 1870 (Yale Univ. Mus.).

From the last-named locality there is but a single small specimen with claws detached, which apparently belongs to this species.

#### 19. *Panopeus hemphilli*, sp. nov.

(Plate xxiv, figs. 12 and 13.)

Carapace somewhat hexagonal, widest at its third antero-lateral teeth. Areolations fairly well marked. On each of the frontal lobes there is a patch of granules. From the base of the depression between the second and third antero-lateral teeth there is a broken line of

granules extending across the carapace. On the gastric areolations these granules are bunched.

Front produced, faintly four-lobed and divided in the middle by a deep, narrow notch, the outer angles of which are ordinarily rather sharp. Median lobes curve backwards to the much-flattened and inconspicuous lateral lobes. On the margin of the front there is a single row of granules which give it a denticulate appearance. These granules extend around the antero-lateral margin, where they are less conspicuous than on the front.

Upper portion of the orbit with two sutures more or less open. Coalesced tooth divided part way to its base by a broad sinus, anterior angle sharp, posterior rounded. Anterior edge of second normal tooth straight, outer edge truncate, rounding gradually backward to the sinus. Third normal tooth slightly hooked forward. A bunch of granules begins on the point and widens out till it occupies the whole raised surface of the tooth. Anterior and posterior margins of fourth tooth very nearly alike, the anterior very slightly concave. The points of the coalesced tooth and the point of the second tooth are in a straight line, and nearly in line with the internal angle of the orbit, giving the carapace a hexagonal appearance. The cuts between the teeth are rounded at the base, and the whole anterior base of the third tooth is hollowed out forming a pit which runs back under the ridge of the tooth.

External hiatus of the orbit V-shaped. Subhepatic tooth very slight.

Outline of male abdomen concave. Second segment short, sides straight, nearly parallel. Seventh sternal segment showing broadly; coxæ of fifth pair of feet altogether cut off from contact with third abdominal segment. Penultimate segment broadest at its distal end, sides straight. Terminal segment triangular, as long as broad.

Meros of chelipeds longer than usual in the genus. Carpus and upper portion of hand thickly covered with large granules. Carpus rugose, carpal depression present. Upper margin of hand surmounted by two ridges. Large hand deep and strong. Small hand with the fingers much deflexed. Dactyl of large cheliped with a cylindrical tooth, which is, however, occasionally wanting, and a tooth on the manus at the base of the dactyl. Prehensile edge of the fingers dentate. Color of the fingers clear white, in the large hand extending nearly to the gape of the claw. Ambulatory feet slender, dactyls hairy.

This species is very distinct from any others that we have examined, and is easily distinguished by its denticulate front in connection with the dentation of the antero-lateral margin, and the white fingers with cylindrical basal tooth.

Length of carapace in large specimen, 6.5 millimetres; width, 9.5 millimetres.

#### RECORD OF SPECIMENS EXAMINED.

Florida: Key Largo (15648); Indian Key (15649); No Name Key (15650); Key West Harbor (15651); Key West (15652); † Dry Tortugas (15653).

20. *Panopeus bermudensis*, sp. nov.

(Plate xx, fig. 2; plate xxiv, figs. 14 and 15.)

Carapace distinctly areolated, posteriorly as well as anteriorly. Areolations ornamented with transverse lines and occasional small clusters of granules.

Front much produced, rather deeply cleft in the center, the cleft rounding out into the median lobes which are produced at this point. Outer angles of the front not produced in some specimens, and slightly in others. Edge of front oblique, thickened, densely granulate, and showing a slight marginal groove. There are two fissures on the upper orbital margin.

First and second teeth of the antero-lateral margin flat and thin; third and fourth thickened, with anterior margins concave and hollowed. The sulcus of the coalesced tooth varies greatly with the specimen. Second tooth the largest, separated from the first by a wide and deep notch; anterior margin straight, pointing slightly forward and not at all hooked; posterior angle nearly straight anteriorly, but rounding backward to the broad and deep notch which separates it from the third tooth. In most specimens the anterior margin of the third tooth is concave. The tooth is much narrower than the second, and its posterior margin curves gradually backward to the bottom of the notch. Fourth tooth much the smallest, sharp pointed, and directed nearly perpendicular to the median line. The depressions between these teeth unite with the depressions between the areolets.

External hiatus of orbit widely V-shaped. Internal angle of lower margin produced into a rather sharp tooth. Remainder of margin not produced in a flattened, rounded tooth, but nearly straight. There is a slight swelling instead of a hepatic tubercle.

Outline of male abdomen slightly concave. First and third segments comparatively narrow and of about equal width. Second segment much narrower, showing the sternal plates. Coxæ of fifth pair of feet not in contact with anchylosed segment. Outline of third normal segment very convex or rounded, of fourth normal very concave, and of fifth normal nearly straight. Penultimate and terminal segments about equal in length. Distal portion of penultimate segment slightly broader than the proximal.

Meros of chelipeds very deep, having a quadrate appearance, and carrying an obtuse tooth on its upper margin. Carpi, chelipeds, and bases of the dactyls finely granulate. Carpal depression well defined along the margin, and extending around to the tooth on the inner angle. Large cheliped very deep and rather thick. Fingers light brown, in some specimens white. Ambulatory feet slender; dactyls very slender and hairy.

The antero-lateral teeth are somewhat like those of *areolatus*, which, however, is separated from *bermudensis* by other strongly marked characters.

Length of carapace in large specimen, 9 millimetres; width, 12 millimetres.

The specimens examined were collected in the Bermudas by Mr. G. Brown Goode, 1876-'77.

## 21. *Panopeus affinis* Streets and Kingsley.

*Panopeus transversus*. W. N. Lockington, Proc. Cal. Acad. Sci., VII, p. 102, 1876 (non Stimpson).

*Panopeus affinis*. Streets and Kingsley, Bull. Essex Inst., IX, p. 106, 1877. J. S. Kingsley, Proc. Boston Soc. Nat. Hist., XX, p. 151, 1879.

*Eurytium affine*. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 334, pl. LX, fig. 1, 1880. E. J. Miers, Challenger Rept., Zool., XVII, p. 140, 1886.

Carapace much flattened, front two-lobed, inner and outer angles of lobes evenly rounded. Front and antero-lateral margins, especially the hepatic regions, granulate. External angle of orbit sharp, separated from the first antero-lateral tooth by a scarcely perceptible sinus, second tooth lobate, third tooth broadly triangular, last tooth very small and obtuse. Male abdomen comparatively broad, and tapering from the middle of anchylosed segment to the tip. Sixth and seventh sternal plates nearly in contact. Large cheliped with a small tooth at the base of the dactyl, and also one on the manus. Ambulatory feet sparsely set with long hairs.

Length of carapace in large specimen, 12.7 millimetres; width, 18 millimetres.

### RECORD OF SPECIMENS EXAMINED.

Gulf of California; U. S. Fish Commission, 1889: San Luis Gonzales Bay, Lower California (16027); Puerto Refugio, Angel Island (16026).

## 22. *Panopeus crenatus* Edwards and Lucas.

(Plate XXI, fig. 4; plate XXIV, fig. 17.)

*Panopeus crenatus*. Milne Edwards and Lucas, D'Orbigny's Voy. l'Amér. Mérid., p. 16, pl. VIII, fig. 1, 1843. Adam White, Crust. in Brit. Mus., p. 18, 1847. James D. Dana, Crust. U. S. Ex. Ex., p. 181, 1852. Spence Bate, Nat. in Brit. Columbia, II, p. 270, 1866. S. I. Smith, Trans. Conn. Acad., II, p. 5, 1869; Rept. Geol. Sur. Canada for 1878-'79 (1880), p. 209 B.

*Eurypanopeus crenatus*. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 318, 1880.

?*Eurypanopeus peruvianus*. A. Milne Edwards, Loc. cit., pl. LX, fig. 3.

Larger than *transversus*, with a more prominent front, and readily distinguished from the latter and from all other species of *Panopeus* that we have examined, by the short second segment of the abdomen, in connection with the lobate antero-lateral margin.

The seventh segment of the male sternum is so exposed and dilated toward the sixth that the verges pass through an entirely closed channel. In the anchylosed segment, the sides of the third normal segment are very much rounded, those of the fourth normal are straight, and of the fifth normal convex. Sides of penultimate straight and parallel. Terminal segment much broader than long.



Length of carapace in large specimen, 19 millimetres; width, 27 millimetres.

The specimens examined are from Callao, Peru; F. H. Bradley (Yale Univ. Mus.).

### 23. *Panopeus harrisi* (Gould).

(Plate XXI, fig. 2; plate XXIV, fig. 16.)

*Pilumnus harrisi*. A. A. Gould, Invert. of Mass., p. 326, 1841.

*Panopeus harrisi*. W. Stimpson, Ann. Lyc. Nat. Hist., VII, p. 55, 1859. S. I. Smith, Rept. Commr. of Fisheries for 1871 and 1872 (1874), pp. 547, 313; Trans. Conn. Acad., v, p. 37, 1879. J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., p. 319, 1878. A. E. Verrill, Check-List of Marine Invert., p. 1, 1879. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, 1, p. 312, pl. LVIII, fig. 3, 1880; Bull. Mus. Comp. Zool., VIII, p. 13, 1880. R. Rathbun, Fishery Industries of U. S., section 1, p. 779, 1884. Carl F. Gissler, Amer. Nat., XVIII, p. 225, 1884.

Carapace convex longitudinally, much less convex transversely; wider posteriorly than the other species of the genus, giving it more of a quadrilateral appearance. There are two transverse lines of granules on the gastric region, a line extending from the posterior tooth to the gastric region, and a line on the mesogastric.

Front very little produced, nearly straight, channeled on its forward edge, giving it a double appearance; upper and lower margins granulate; median notch triangular.

Antero-lateral teeth not prominent. Coalesced tooth inconspicuous, flattened. Second and third teeth point obliquely forward. Last tooth small.

External hiatus of orbit a very slight, nearly closed fissure. Subhepatic tubercle wanting.

Second segment of male abdomen short, much broader at its distal end, sides nearly straight. Seventh sternal plate exposed, in contact with the sixth, covering the verges. Abdomen much constricted at the articulation of the anchylosed and penultimate segments. Terminal segment about as long as broad. Distal end flattened, giving it a subrectangular shape.

Distal edge of carpus bordered by a line of granules. Lines and bunches of granules are scattered over the upper surface. Carpal groove prominent. Hands and fingers white, with no large tooth at the base of the dactyl and none on the manus. The two ridges on the upper edge of the hand are granulate, and there are granules also on the upper edge of the fingers. Fingers slender, their prehensile edges evenly dentate. Ambulatory feet long, slender, and compressed.

Some of the specimens from the region of Winyah Bay, South Carolina, were found in streams where the water was entirely fresh.

Length of carapace in large specimen, 11 millimetres; width, 14.5 millimetres.

## RECORD OF SPECIMENS EXAMINED.

Beasley's Point, New Jersey (Yale Univ. Mus.).

Potomac River (3176).

Near Winyah Bay, South Carolina; U. S. Fish Commission, 1890-'91.

St. John's River, Florida (Yale Univ. Mus.).

Mouth of Indian River, Florida (Yale Univ. Mus.).

**24. *Panopeus limosus* (Say).**

*Cancer limosa*. Thomas Say, Jour. Acad. Nat. Sci. Phila., I, p. 446, 1817.

*Panopeus limosus*. Milne Edwards, Hist. Nat. des Crust., I, p. 404, 1834. J. E. De Kay, Crust. of N. Y., p. 5, 1844. Adam White, Crust. in Brit. Mus., p. 18, 1847. Lewis R. Gibbes, Proc. Acad. Nat. Sci. Phila., v, p. 23, 1850; Proc. Amer. Assoc. Adv. Sci., III, p. 176, 1850. H. Lucas, Hist. Nat. des Crust., p. 90, 1851. E. v. Martens, Arch. für Natur., 38, p. 91, 1872.

*Eurytium limosum*. W. Stimpson, Ann. Lyc. Nat. Hist., VII, p. 56, 1859. J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., p. 319, 1878; XXXI, p. 394, 1879. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 332, pl. LX, fig. 2, 1860. E. J. Miers, Challenger Rept., Zool., XVII, p. 141, 1886.

Numerous specimens of this well-known crab were found in the marshy banks, a little below high-tide mark, in burrows partially filled with water. In the fresh state they are readily recognized and separated from all other crabs by the color. Carapace, a brilliant purplish blue; carpus and hand, bluish; proximal upper half of the dactyls of chelipeds, pink; remainder of fingers, porcelain white; lower portion of chelipeds and carpal tooth, orange-yellow.

Carapace very convex longitudinally, nearly straight transversely. Front much deflexed, composed of two lobes, the inner and outer angles alike and evenly rounded. A slight emargination in the coalesced tooth. Second tooth semi-lobate; third and fourth short, pointed, triangular.

Carpal groove wanting. Fingers evenly dentate. In the larger cheliped there is a slight tooth on the dactyl, and also one on the manus.

Appendages of male abdomen very much like those of *herbstii*, with the *obesus* type of which it is associated, burrowing in the same bank.

Length of carapace, 28 millimetres; width, 42.5 millimetres.

## RECORD OF SPECIMENS EXAMINED.

Port Royal Island, South Carolina; U. S. Fish Commission, 1891 (16028).

Key West, Florida (9899, 13824).

Curaçao; U. S. Fish Commission, 1884 (7579).

Plataforma, Bahia, Brazil; R. Rathbun, Hartt Explorations, 1875-'76.

## SPECIES NOT EXAMINED.

**1. *Panopeus chilensis* Edwards and Lucas.**

*Panopeus chilensis*. Milne Edwards and Lucas, D'Orbigny's Voy. l'Amér. Mérid., p. 16, pl. VIII, fig. 2, 1843. Gay, Historia de Chile, Zool., 3, p. 139, 1849. S. I. Smith, Proc. Boston Soc. Nat. Hist. XII, p. 279, 1869. T. H. Streets, Proc. Acad. Nat. Sci. Phila., (3), I, p. 239, 1871. W. N. Lockington, Proc. Cal. Acad. Sci., VII, p. 103, 1876. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 315, 1860.

Carapace convex, areolated. Front produced, narrower than in *herbstii*. Antero-lateral teeth triangular, the last three pairs with points directed forward.

This species and *P. validus* Smith are very closely related, but our specimens of the latter differ from the figure of *chilensis* given by Edwards and Lucas, in the deep but closed median cleft of the front, in the broader bases of the antero-lateral teeth, in the deeper sulcus of the coalesced tooth, and the stouter ambulatory feet. The front of *chilensis* is nearly straight, while in *validus* the lateral lobes are produced and prominent. The fingers also of *chilensis* are not channeled.

Length, 26 millimetres; width, 38 millimetres.

Chili; Panama; west coast of Mexico.

## 2. *Panopeus subverrucosus* (White).

*Ozius ? subverrucosus*. Adam White, Crust. in Brit. Mus., p. 19, 1847; Proc. Zool. Soc. London, xv, p. 226, 1847.

*Panopeus subverrucosus*. E. J. Miers, Challenger Rept., Zool., xvii, p. 129, 1886.

Carapace with latero-anterior side short, with three deep incisions forming four lobes, the two middle truncated; carapace above irregular, the edges and under-side thickly covered with small warts. Front formed of two truncated widish lobes, separated by a very slight notch; a deepish notch between the front and the orbit, and a sinus between the outer orbital angle and the first lobe of the side. Hab. — ?

This species is represented in the British Museum by a carapace only.

## 3. *Panopeus lævis* Dana.

*Panopeus lævis*. J. D. Dana, Crust. U. S. Ex. Ex., i, p. 180, 1852.

"† *Panopeus lævis*." E. J. Miers, Challenger Rept., Zool., xvii, p. 129, 1886.

Carapace smooth, scarcely shining, not distinctly areolate, front nearly straight, not produced, minutely emarginate, antero-lateral margin thin, four-lobed, second and third lobes neatly dentiform and acute, the posterior margin of these teeth arcuate, fourth narrower. Anterior feet very unequal, unarmed, rounded above, hand smooth, a little shining on outside, movable finger smooth, without a large basal tooth. Eight posterior feet slender, margins pubescent, third joint nearly naked.

Locality doubtful.

The figure as given by Dana represents a species very distinct from any that we have examined.

## 4. *Panopeus americanus* Saussure.

*Panopeus americanus*. H. de Saussure, Rev. et Mag. de Zool., (2), 9, p. 502, 1857; Mém. Soc. Phys. Genève, xiv, p. 432, pl. 1, fig. 8, 1857. W. S[timpson], Amer. Jour. Sci. (2), 27, p. 446, 1859. E. v. Martens, Arch. für Natur., 38, p. 90, 1872. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, i, p. 311, 1880.

Small; carapace flat, more quadrate than *serratus*; margins lobate. Saussure, in his description and figure, represents this species with

lobate teeth, which, in connection with the proportionately greater length of the carapace, readily distinguishes it from any other species. West Indies.

#### 5. *Panopeus abbreviatus* Stimpson.

*Panopeus abbreviatus*. W. Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, p. 211, 1860.

*Eurypanopeus abbreviatus*. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 320, pl. LIX, fig. 3, 1881.

Carapace broad, transversely rugose; regions well defined, but not protuberant; front rather narrow and but little projecting; margin seen from above nearly straight and obliquely truncated or beveled, the beveled surface being granulated; supra-orbital fissure distinct; antero-lateral teeth normal in number and rather prominent; subhepatic regions granulated; a slight tuberculiform prominence beneath the first antero-lateral tooth; chelipeds smooth; surface microscopically punctated.

#### Barbados.

Edwards's figure shows the front broad, the antero-lateral margin lobate, the fourth tooth scarcely perceptible. The appearance of the carpus is something like that of *ovatus* from Lower California.

#### 6. *Panopeus africanus* A. Milne Edwards.

*Panopeus africanus*. A. Milne Edwards, Ann. Soc. Entom. France (4), 7, p. 276, 1867; Miss. Sci. au Mexique, pt. 5, I, p. 308, 1880. E. J. Miers, Challenger Rept., Zool., XVII, p. 129, 1886.

A. Milne Edwards says of this species that it is much like *chilensis*, but the front is less advanced, the carapace more granulate, the antero-lateral teeth are directed more outward and less forward, and lastly, the feet are much more pubescent than in *chilensis*.

#### West coast of Africa.

#### 7. *Panopeus bradleyi* Smith.

*Panopeus Bradleyi*. S. I. Smith, Proc. Boston Soc. Nat. Hist., XII, p. 281, 1869.

W. N. Lockington, Proc. Cal. Acad. Sci., VII, p. 102, 1876. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 317, 1880.

Carapace transversely flat, longitudinally convex; areolations well marked. Antero-lateral teeth upturned; front slightly prominent, nearly horizontal, edge thin; sinus of coalesced tooth rounded; remaining teeth rather prominent, triangular, thickened along the anterior edge. Chelipeds with carpi rugose externally. Larger hand stout, fingers short, widely gaping, irregularly toothed within, and with a stout tooth at the base of each finger, the one on the dactyl shutting just within the other.

Length of carapace in the male, 8.4 millimetres; breadth, 11.5 millimetres.

#### Panama.

8. *Panopeus purpureus* Lockington.\*

*Panopeus purpureus*. W. N. Lockington, Proc. Cal. Acad. Sci., VII, p. 101, 1876. Streets and Kingsley, Bull. Essex Inst., IX, p. 105, 1877. J. S. Kingsley, Proc. Boston Soc. Nat. Hist., XX, p. 152, 1879. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 316, pl. LVII, fig. 3, 1880.

Kingsley says of this species:

This form is very near *P. validus* Smith, and probably will prove to be merely a variety of it. In comparison with Smith's description and with authentic specimens of *P. validus* brought from the Gulf of Fonseca, by J. A. McNeil, it presents the following differences: Carapace smoother, and the granulous rugæ less numerous; front less prominent, and, seen from above, nearly straight; fissures of the orbit less evident; tooth at inner angle of orbit below broader and shorter, second normal tooth of antero-lateral margin separated from the angle of the orbit by a narrower, more triangular notch; notches between the remaining teeth narrower, the teeth themselves having a distinct elevated margin. Propodus of chelipeds with an obtuse crest above; the tooth on the outer surface of larger hand nearly obsolete, dactylus with a large basal tooth. Ambulatory feet less compressed than in *P. validus*.

Lower California; west coast of Nicaragua.

This species appears to us to be nearer to *chilensis* than to *validus*.

9. *Panopeus xanthiformis* A. Milne Edwards.

*Panopeus xanthiformis*. A. Milne Edwards, Miss. Sci. au Mexique, pt. 5, I, p. 353, pl. LIII, fig. 4, 1880; Bull. Mus. Comp. Zool., VIII, p. 13, 1880. E. J. Miers, Challenger Rept., Zool., XVII, p. 129, 1886.

Resembles *Xanthodes*. Carapace flattened, granulated on the antero-lateral borders. Front composed of two lobes; median fissure narrow. Orbit wide; inferior border crenulate. First antero-lateral tooth small,

\*Since this paper has been in type, several specimens of *purpureus*, from Guaymas, Mexico, have been presented to the National Museum by Mr. P. L. Jouy. The following description is based on these specimens:

Carapace convex in both directions, finely granulate, marked on the anterior half by transverse granulous rugæ. Front nearly straight, faintly four-lobed. Coalesced tooth with shallow, rounded sinus. Remaining teeth much as in *herbstii*, not strongly hooked nor separated by broad sinuses as in *validus*. Suborbital margin three-lobed. External hiatus deep and narrowly V-shaped. Subhepatic tubercle prominent.

Proximal end of second segment of male abdomen much wider than the distal end, prolonged laterally in an obtuse lobe. Outline of last three segments resembling that of *herbstii*. Seventh segment of sternum slightly exposed.

Chelipeds granulate. Carpus broad, finely rugose; tooth at inner angle sharp, groove present. Hands short, deep, with a double crest above. Dactyl of large hand with a stout tooth; a broad tooth on the hand at the base of the dactyl. Dactyls of third and fourth ambulatory feet much longer than in *validus*.

Color of carapace, dark, bluish brown; upper surface of chelipeds, lighter violet brown; both carapace and chelipeds spotted with irregular blotches of dark reddish brown. Under surface of chelipeds, orange yellow. Fingers light brown, white at the tips.

This species is very distinct from *validus*, and is well figured by A. Milne Edwards. Length, 25.5 millimetres; width, 37 millimetres.

Guaymas, Mexico; P. L. Jouy, 1891 (16080).

rounded; second and third large; last tooth small and pointed. Chelipeds finely granulated and rugose.

Length, 9 millimetres; width, 13 millimetres.

West Indies, 73 to 118 fathoms.

10. *Panopeus herbstii granulosus* A. Milne Edwards.

Miss. Sci. au Mexique, pt. 5, 1, p. 309, 1880.

Variety of *herbstii* found at Bahia, Brazil, and remarkable for its wide and very granulate carapace.

11. *Panopeus crassus* A. Milne Edwards.

Loc. cit., p. 313, pl. LVII, fig. 1.

Distinguished from *herbstii* by its wider carapace, less convex transversely, and much swollen mesogastric region. Antero-lateral portion finely granulated. Front much produced, horizontal. External angles sharp, and produced much in advance of the orbital angles. Chelipeds very strong.

Length, 36 millimetres; width, 65 millimetres.

Brazil.

12. *Panopeus rugosus* A. Milne Edwards.

Loc. cit., p. 314, pl. LVII, fig. 4.

Carapace very wide and granulate. Epigastric, protogastric, and protobranchial regions with prominent transverse lines. Front with triangular median notch, not a straight fissure, as in *herbstii* and *crassus*. Front four-lobed, median lobes rounded and produced, lateral lobes nearly straight. External angle of orbit little advanced and separated from the first antero-lateral tooth by a slight sinus. All the teeth are bordered by a line of granules. Chelipeds covered with fine granules. Hands with two prominent longitudinal lines above. Ambulatory feet long, dactyls slender.

Species easily distinguished by the form of the front, by the antero-lateral teeth, by the granulation of the carapace and chelipeds, and by the length of the ambulatory feet.

Length, 39 millimetres; width, 60 millimetres.

Bahia, Brazil.

13. *Panopeus convexus* A. Milne Edwards.

Loc. cit., p. 316, pl. LVIII, fig. 5.

Edwards says of this species:

Carapace very convex in both directions. Areolations prominent; nearly smooth. Front less advanced than in *chilensis*, more depressed, lateral angle less conspicuous. External orbital angle not produced, scarcely separated from the first antero-lateral tooth. (Fig. 5, loc. cit., represents it as deeply separated.)

Length, 25 millimetres; width, 36 millimetres.

Chili.

14. *Panopeus otagoensis* H. Filhol.

Rec. Vénus, III, (p. 379), 1886.

Campbell Island, South Pacific.

15. *Panopeus latifrons* J. G. de Man.

Arch. für Natur., I, p. 265, pl. ix, fig. 4, 1887.

Length, 4.8 millimetres; breadth, 7.2 millimetres.

Amboina.

This species will doubtless be eventually referred to some other genus. The figure is hardly that of a *Panopeus*.

## EXPLANATION OF PLATES.

(Plates XIX-XXII from photographs by Mr. T. W. Smillie; plates XXIII and XXIV drawn by Dr. J. C. McConnell.)

## PLATE XIX.

- Fig. 1. *Panopeus herbetii* Edw.  
 2. *Panopeus herbetii* Edw. (obesus type).  
 3. *Panopeus validus* Smith.  
 Figures natural size.

## PLATE XX.

- Fig. 1. *Panopeus hartii* Smith,  $\times \frac{1}{2}$ .  
 2. *Panopeus bermudensis* sp. nov.,  $\times \frac{1}{2}$ .  
 3. *Panopeus occidentalis* Saus., natural size.  
 4. *Panopeus dissimilis* sp. nov.,  $\times \frac{1}{2}$ .  
 5. *Panopeus depressus* Smith,  $\times \frac{1}{2}$ .

## PLATE XXI.

- Fig. 1. *Panopeus parvulus* (Fabr.), natural size.  
 2. *Panopeus harrisii* (Gould),  $\times \frac{1}{2}$ .  
 3. *Panopeus areolatus* sp. nov., natural size.  
 4. *Panopeus crenatus* Edw. and Lucas, natural size.  
 5. *Panopeus planissimus* Stimpson,  $\times \frac{1}{2}$ .

## PLATE XXII.

- Fig. 1. *Panopeus packardii* Kingsley.  
 2. *Panopeus transversus* Stimpson.  
 3. *Panopeus angustifrons* sp. nov.  
 4. *Panopeus sayi* Smith.  
 5. *Panopeus texanus* Stimpson.

Figures natural size.

## PLATE XXIII.

- Fig. 1. *Panopeus dissimilis* sp. nov., male abdomen.  
 2. *Panopeus parvulus* (Fabr.), male abdomen.  
 3. *Panopeus parvulus* (Fabr.), larger manus.  
 4. *Panopeus depressus* Smith, male abdomen.

16. 5. *Panopeus depressus* Smith, smaller manus.
6. *Panopeus packardii* Kingsley, male abdomen.
7. *Panopeus sayi* Smith, larger manus.
8. *Panopeus sayi* Smith, larger manus, with color more restricted.
9. *Panopeus texanus* Stimpson, male abdomen.
10. *Panopeus herbstii* Edw., larger manus.
11. *Panopeus herbstii* (obesus type), larger manus.
12. *Panopeus herbstii*, male abdomen.
13. *Panopeus validus* Smith, male abdomen.
14. *Panopeus occidentalis* Saus., male abdomen.

Figures enlarged.

PLATE XXIV.

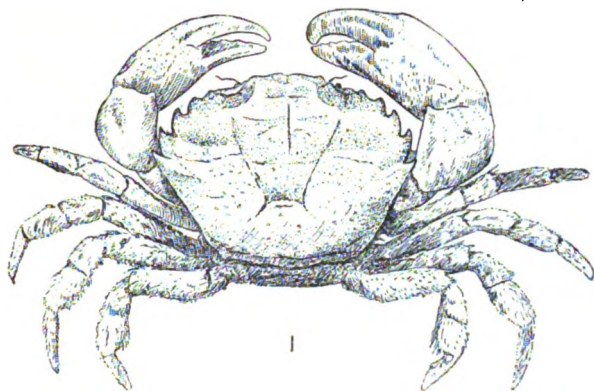
- g. 1. *Panopeus planissimus* Stimp., male abdomen.
2. *Panopeus planissimus* Stimp., larger manus.
3. *Panopeus serratus* Saus., outline of carapace.
4. *Panopeus serratus* Saus., male abdomen.
5. *Panopeus harttii* Smith, male abdomen.
6. *Panopeus wurdemannii* Gibbes, male abdomen.
7. *Panopeus wurdemannii* Gibbes, outline of carapace.
8. *Panopeus ovatus* sp. nov., outline of carapace.
9. *Panopeus transversus* Stimp., male abdomen.
10. *Panopeus planus* Smith, outline of carapace.
11. *Panopeus planus* Smith, male abdomen.
12. *Panopeus hemphillii* sp. nov., outline of carapace.
13. *Panopeus hemphillii* sp. nov., male abdomen.
14. *Panopeus bermudensis* sp. nov., male abdomen.
15. *Panopeus bermudensis* sp. nov., larger manus.
16. *Panopeus harrisii* (Gould), male abdomen.
17. *Panopeus crenatus* Edw. and Lucas, male abdomen.
18. *Panopeus angustifrons* sp. nov., male abdomen.

Figures enlarged.

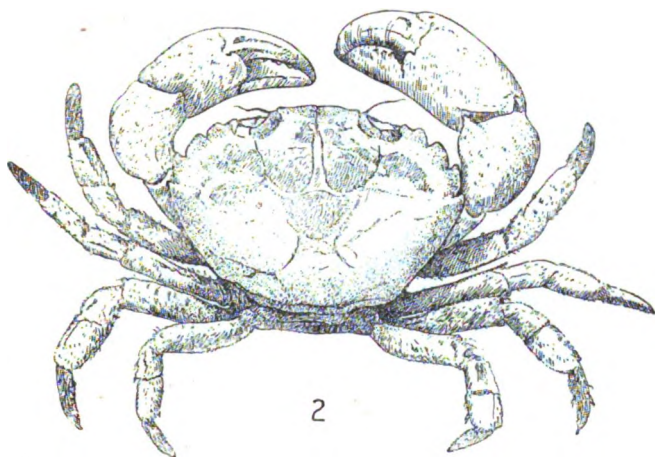
Proc. N. M. 91—25



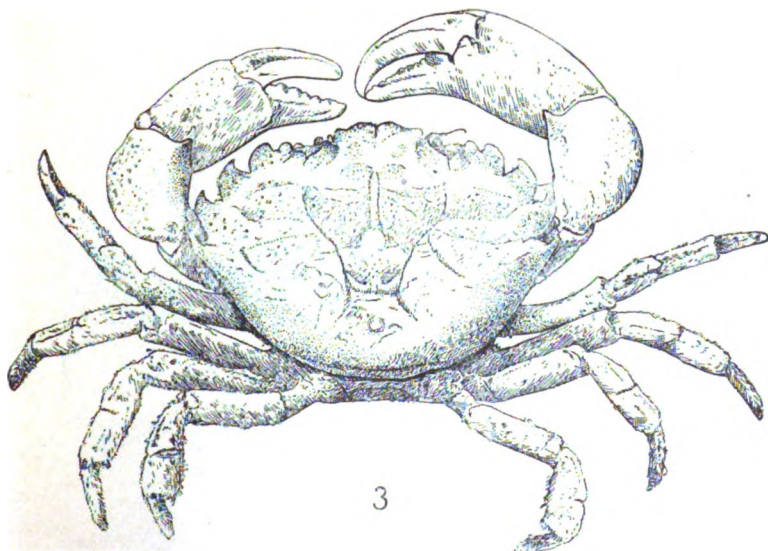




1



2



3

FIG. 1. *Panopeus herbstii*. (Natural size.)  
 FIG. 2. *Panopeus herbstii* (*cobesus* type). (Natural size.)  
 FIG. 3. *Panopeus validus*. (Natural size.)



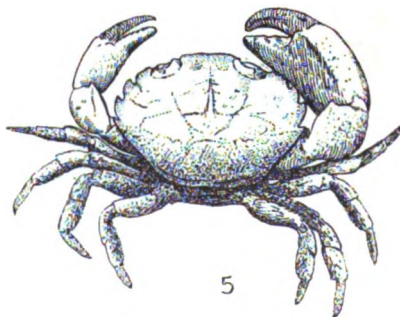
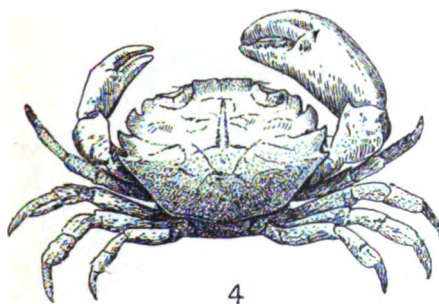
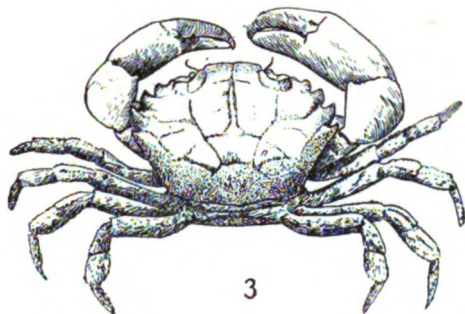
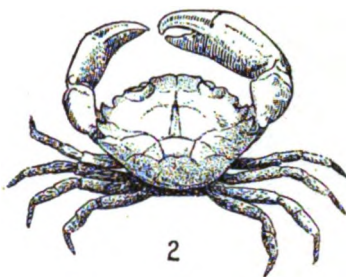
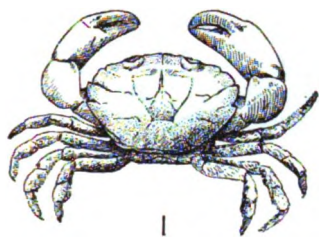
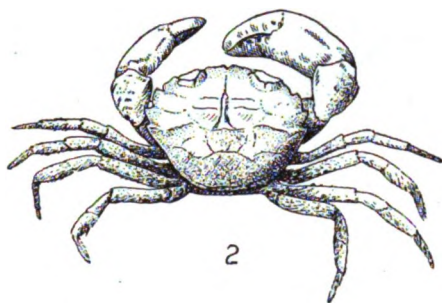


FIG. 1. *Panopeus harttii*. (1½ natural size.)  
 FIG. 2. *P. bermudensis*. (1½ natural size.)  
 FIG. 3. *P. occidentalis*. (Natural size.)  
 FIG. 4. *P. dissimilis*. (1½ natural size.)  
 FIG. 5. *P. depressus*. (1½ natural size.)

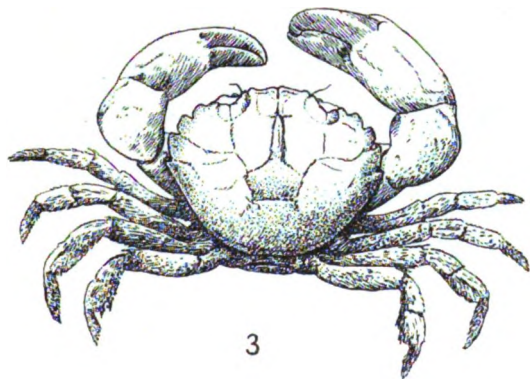




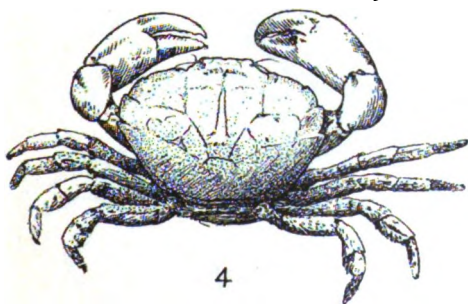
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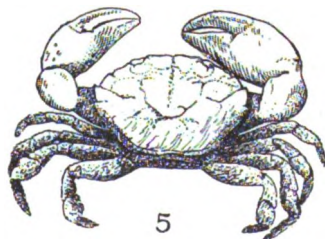
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3



4



5

FIG. 1. *Panopeus parvulus*. (Natural size.)  
 FIG. 2. *P. harrisi*. (1½ natural size.)  
 FIG. 3. *P. areolatus*. Natural size.  
 FIG. 4. *P. crenatus*. (Natural size.)  
 FIG. 5. *P. planissimus*. (1½ natural size.)



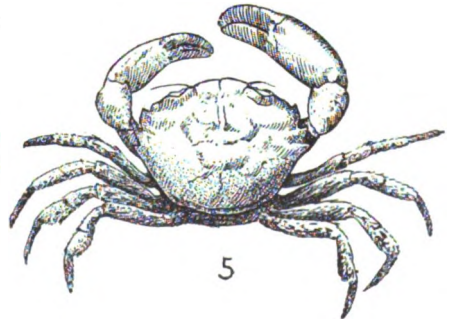
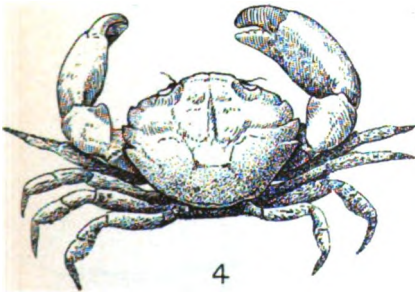
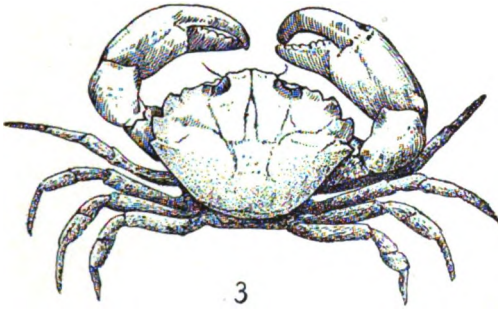
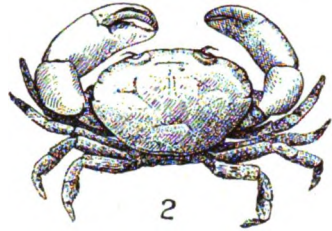
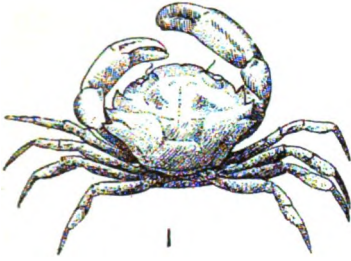


FIG. 1. *Panopeus packardii*. (Natural size.)  
FIG. 2. *P. transversus*. (Natural size.)  
FIG. 3. *P. angustifrons*. (Natural size.)  
FIG. 4. *P. sayi*. (Natural size.)  
FIG. 5. *P. texanus*. (Natural size.)





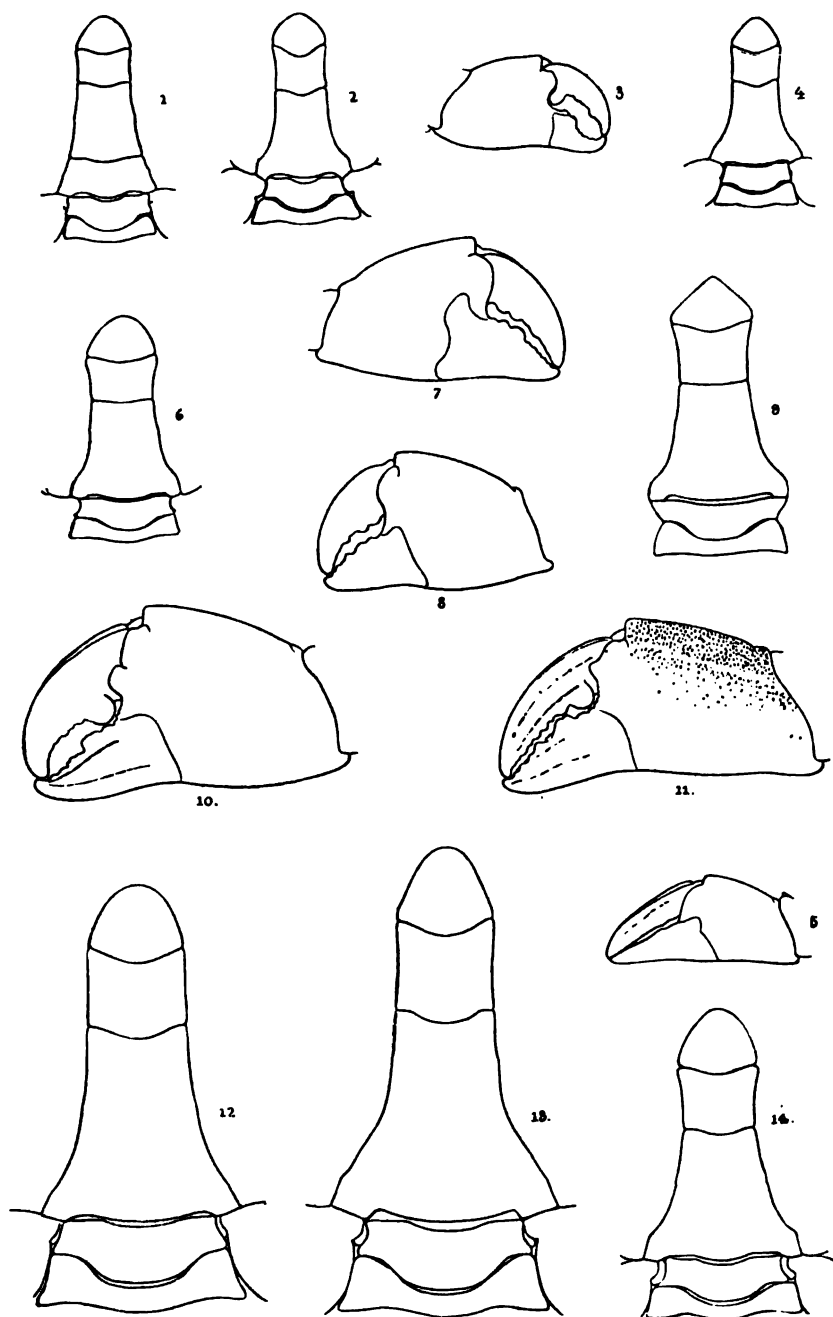
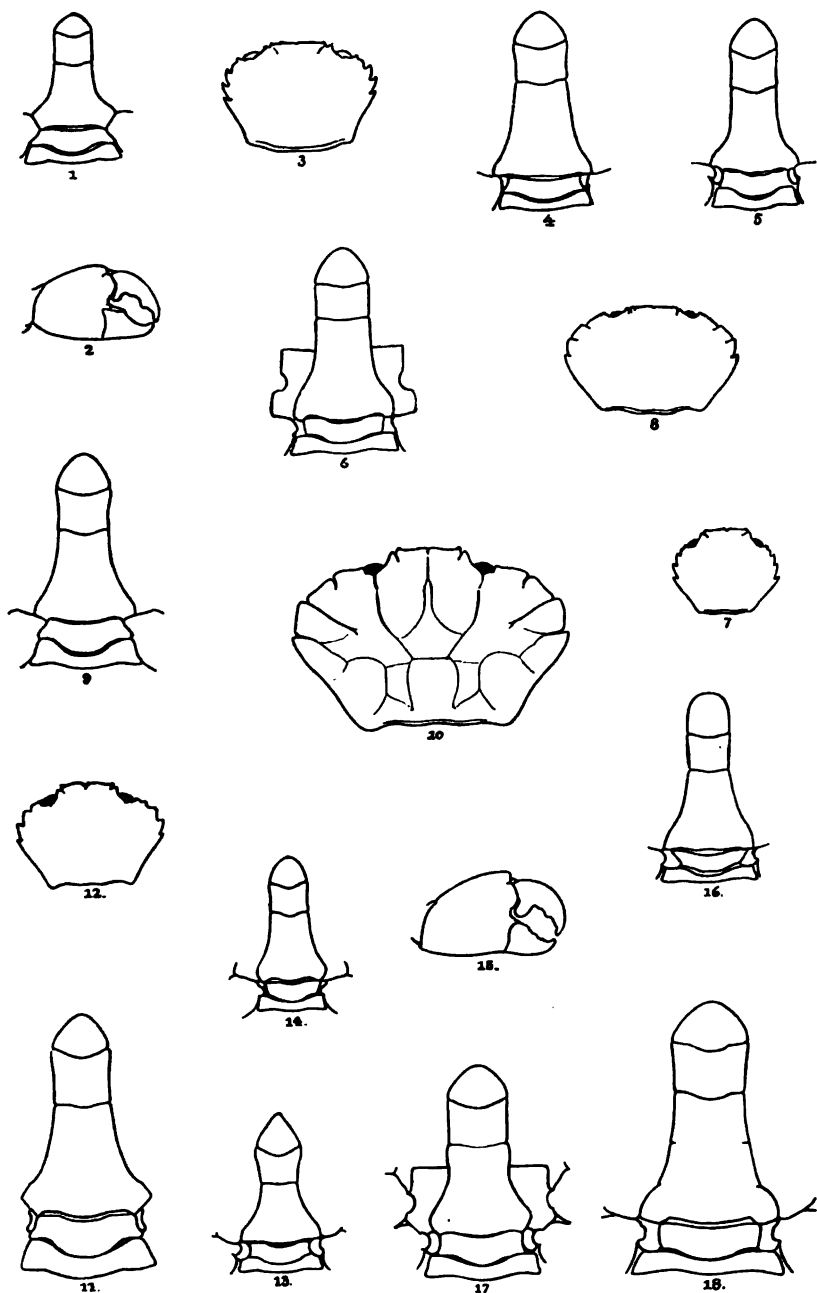


FIG. 1. *Panopeus dissimilis*.  
 FIGS. 2, 3. *P. parvulus*.  
 FIGS. 4, 5. *P. depressus*.  
 FIG. 6. *P. peckardii*.  
 FIGS. 7, 8. *P. sayi*.

FIG. 9. *P. texanus*.  
 FIGS. 10-12. *P. herbstii*.  
 FIG. 13. *P. validus*.  
 FIG. 14. *P. occidentalis*.

(Figures enlarged.)





FIGS. 1, 2. *Panopeus planissimus*  
 FIGS. 3, 4. *P. serratus*.  
 FIG. 5. *P. hartii*.  
 FIGS. 6, 7. *P. wurdemannii*.  
 FIG. 8. *P. ovatus*.  
 FIG. 9. *P. transversus*.

FIGS. 10, 11. *P. planus*.  
 FIGS. 12, 13. *P. hemphillii*.  
 FIGS. 14, 15. *P. bermudensis*.  
 FIG. 16. *P. harrisii*.  
 FIG. 17. *P. crenatus*.  
 FIG. 18. *P. angustifrons*.

(Figures enlarged.)



## SOME OBSERVATIONS ON THE HAVESU-PAI INDIANS.

BY

R. W. SHUFELDT, M. D.

(With Plates xxv, xxvi.)

Several years ago when the writer had the opportunity of studying some of the tribes of our Indians in the southwest, especially those found in northwestern New Mexico and over the adjacent boundary of Arizona, he met with Mr. Benj. Wittick, formerly a photographer in the employ of the U. S. Geological Survey, who was making a collection of photographs of the Indians of that region. He had visited that least known tribe of Arizona Indians, the Havesu-pai, of the so-called Su-pai Cañon, and had obtained some excellent pictures of them. I was so fortunate as to secure prints of Mr. Wittick's photographs of that race. As we have no good illustrations of those people that I am aware of, it is hoped that the two plates we are enabled to reproduce here of them will be found useful to the anthropologist.

In every sense of the word the Havesu-pais are a dying race. There is but a remnant of them now in existence; I have heard it said, less than two hundred. They exist in one of the grandest cañons in all Arizona, living in their primitive lodges along the bank of the stream that passes through it. Upon looking up such matter as had been written upon this departing tribe of Indians, I found it to be exceeding meager; indeed there is little or nothing known about them. From the very inaccessible place of their abode they have been very rarely seen, and only on few occasions by scientific men. Mr. Albert S. Gatschet of the Bureau of Ethnology of the Smithsonian Institution confirmed this opinion, and said that those Indians were known in former times by the name of "Koxoninos," or "Cochnichnos," but that they were the "Cosninos" of the Moquis of Arizona. Properly they should be known by the name that the Yumas call them, that is the Havesu-pai, or Avésu-pai, meaning the "down below people, or a tribe or race that live down in the cañon." "Páya, pái," being "all, people." They themselves claim to be descended from the Wolapai.

In Vol. III of the Pacific Railroad Reports, Whipple barely alludes to them. On page 80 of that work he states that "upon old Spanish

maps the San Francisco mountain is represented as belonging to the continuous Mogollon chain, which comes from the east southeast, and was called Sierra de los Cosninos, the name of a tribe of Indians inhabiting this region. I am under the impression that Leroux, the early explorer in that part of the country was finally murdered by the Cosninos, but I do not remember that the account has ever been printed." Whipple also refers to the "Cosnino caves," remarking that "the Cosnino caves had been plastered with mortar, showing more artistic skill than is practiced by the present occupants of the country" (*loc. cit.*, p. 15). And again on page 19 he goes to show that, taken collectively, the Pontos, Cosninos, and Yampais together number 6,000 souls; of these 2,000 were Yampais (p. 17). But all this is very brief and unsatisfactory.

Capt. John G. Bourke in his work on "The Snake-dance of the Moquis of Arizona" (1884), says, "At Keam's ranch we met Mr. Alexander Steven, a bright Scotchman who during the past 12 years has had considerable experience as a metallurgist and mining prospector in Nevada and Utah. He gave me a thrilling account of his journey westward to the country of the Cohoninos, a tribe of Indians living in the cañon of Cataract Creek, near its junction with the Grand Cañon of the Colorado in this Territory.

"They number only from forty to fifty warriors, live in the cliffs in winter, and build 'wickyups' or sapling lodges in summer. They say that the Hualpais (Wolapais), Apache-Mojaves, and themselves are all one people—Cohoninos—but that *their* proper designation is the "Ah-Su-pai.

"They raise an abundance of finest peaches, good corn and melons, and weave unusually fine and beautiful baskets. They are great hunters, and eke out a living by trading off buckskins, and sometimes mountain lion pelts, to the Moquis, Navajos, and Apaches.

"The cañon in which they dwell is 4,500 feet deep, and is that of the Cataract Creek, a strong body of clear water tumbling by a series of cascades into the Grand Cañon of the Colorado, 1,500 feet still deeper, and separated from their village by a series of blood-curdling precipices and chasms" (pp. 80, 81). Captain Bourke, in speaking of the Moquis, says further, that "Intimate commercial relations are maintained with the Cohoninos or Ava-Supais on the west (*loc. cit.*, p. 254).

In a lecture before the National Academy of Sciences, delivered in Washington, April 22, 1882, Mr. Frank H. Oushing in referring to the Zunians said, "Interesting among the hero-gods is the great priest of all religious orders save that of the bow, *Poskai Ank'ia*. In the days of the new, yet not until after men had begun their journey toward the east, he is supposed to have appeared among the ancestors of the Zuñis, the Taos, the Coconinos, and the Moqui Indians, so poor and ill-clad as to have been ridiculed by mankind." This lecture was afterwards published in The Popular Science Monthly, of New York (1882, p. 191).

Mr. Cushing's best account of these people, however, is published in another connection, wherein he relates how he made a long and dangerous journey from Moqui to the Supai Cañon.\*

Following his description of hazardous descent into that fearful gorge, Cushing goes on to say in his article, that "the first Ha-va-su-pai I saw may be taken as a type of his race. But lightly clothed, a strange close head-band around his temples, he swiftly passed from one bush to another as we emerged from the little grove. Below us stretched a green, moist plain of sandy soil, nearly two miles long by half a mile at its greatest width. We could catch only occasional glimpses of it through the rank growth of willows, the leaves of which everywhere brushed our heads as we rode along the river trail; these glimpses, however, revealed numerous cultivated fields of corn, beans, sunflowers, melons, peaches, apricots, and certain plants used in dyeing and basket making, and usually carefully protected by hedges of wattled willows or fences of cottonwood poles. Everywhere these fields were crossed and recrossed by a net work of irrigating canals and trails. Here and there were little cabins, or shelters, flat-roofed, dirt-covered, and closed in on three sides by wattled flags, canes, and slender branches, while the front was protected by a hedge like those of the fields, only taller, placed a few feet before the house, and between which and the house burned smoky fires."

"The houses were always nestled down among the thick willows bordering the river, or perched on some convenient shelf, under the shadows of the western precipice. In several places, within some of the great horizontal cracks of these western cliffs, and often high up, were little buildings of stone laid in mud plaster, and not unlike the cliff dwellings we had observed on the way down, and of which ruins exist in almost every cañon throughout the great southwest."

"When we again caught sight of our Kuhni, in a little opening near the trail, he was evidently uncertain whether to run forward and warn the tribe—whose voices, mingled with the barking of dogs and the murmuring of the river, could be heard below—of our coming, or wait to greet us. Finally, he shouted in a rapid, gurgling, soft sort of language, that the villagers were coming; and then, with sort of a questioning smile, turned toward us, keeping up a ceaseless gibberish, but eyeing me closely, and evidently thinking me the most curious member of the party."

The only other facts of importance given in this narrative are that those Indians have their medicine men and use the "sweat house," a plan of treatment seen among many other tribes. They have a great number of dogs about their village, and many of the families are blessed with from five to six children. They are, so far as the writer is aware, upon excellent terms of friendship with the whites. I am not aware

\*Cushing, Frank Hamilton. "The Nation of the Willows." *The Atlantic Monthly*, September, 1882, pp. 362-374. The quotation I make is from page 374.



that Mr. Cushing has published anything further upon these very interesting people, although he was evidently among them for several days and must have in that time amassed some considerable information.

This is absolutely all the information of any importance that I have been enabled to get together about these Indians, and Mr. Gatschet has informed me that it is about all that has ever been written.

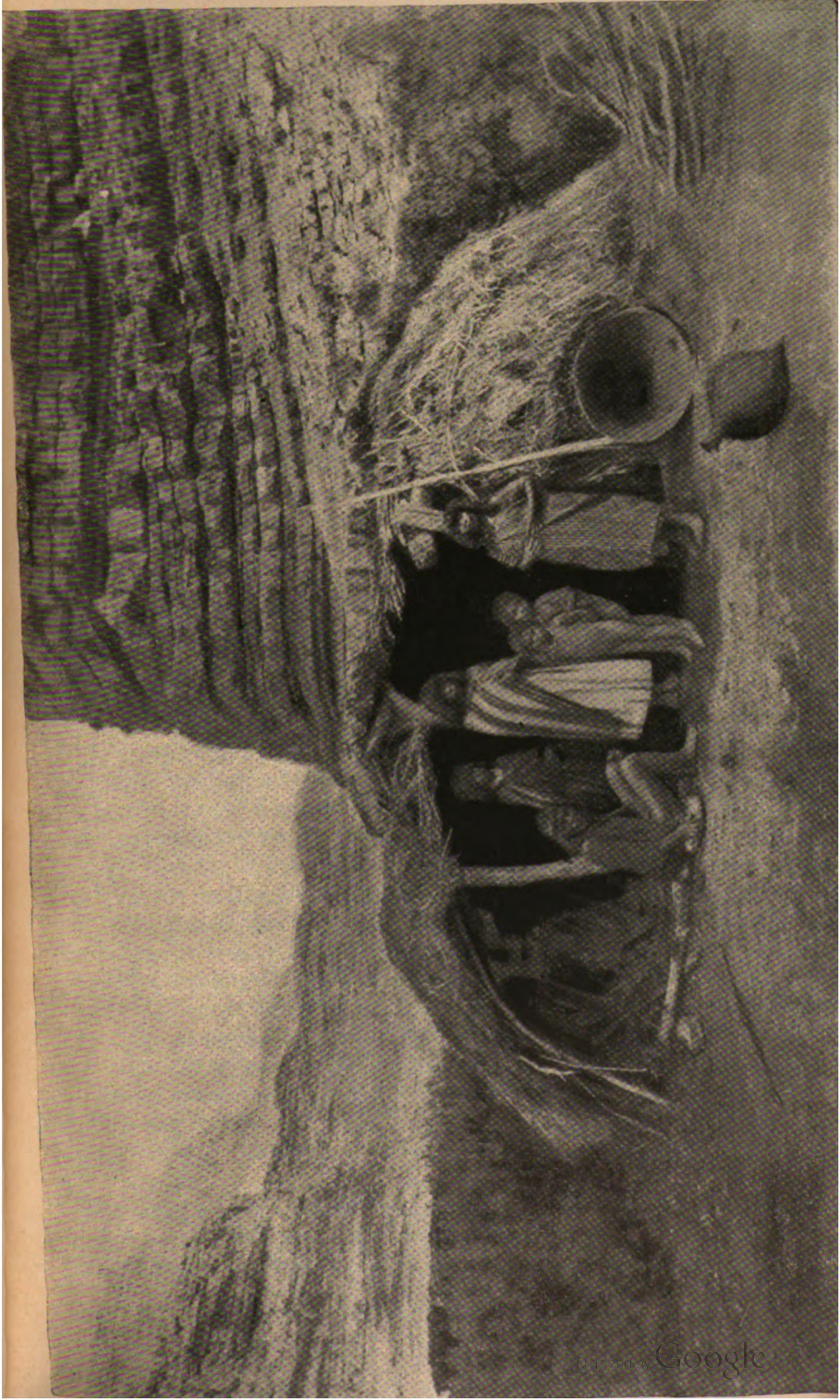
Science in general, and anthropology in particular, I must believe, would be well repaid could a good and active anthropologist live with these Indians for a month or more and gather up everything there is to be known about them.

The styles of their lodges and their architecture are well shown in my two plates. We can also see other objects there worthy of our attention, as the varied costumes of the men, women, and children, as well as the peculiar forms of their curious baskets lying about. Further, in Pl. II, it is interesting to note the fashion of fixing the hair in the women and in the girls; it would seem that it pointed to affinities with the Pueblan Indians.



AN AGED PAIR OF HAVESU-PAI INDIANS.







## THE NAVAJO BELT-WEAVER.

BY

R. W. SHUFELDT, M. D.

(With Plate xxvii.)

For a number of years the writer of the present article lived in the northwestern part of New Mexico, and while there such time as could be spared from his duties as a military surgeon at one of the stations in that little frequented part of our country, was entirely given over to studies of everything the region afforded.

The camera and pencil were constantly in use and the several tribes of Indians studied with their simple arts, their habits, and their history. I have watched the native weavers, both among the Zuni and the Navajos, manufacture their beautiful blankets, belts and sashes, fabrics now so celebrated in works devoted to the ethnology of these interesting people. Among the Navajos one will see a great many blankets made before an opportunity will be presented for him to observe the labors of a belt-weaver. The reason for this is, that blankets are a universal necessity with them, while the belt is principally used as a supplementary adornment in dress. As my time for leaving the country drew near I almost despaired of getting a good photograph of the belt-weaver and the study of the loom she used. But a month before my departure an Indian came into my study one morning, beaming all over with the welcome information that one of the best weavers in the tribe had started the making of a belt in front of one of their huts. These Indians were then building close to the confines of the garrison.

The first day I studied her methods of procedure and the second day I succeeded in obtaining several excellent pictures of this weaver at work. My best result is here offered as an illustration, and it well shows the entire scene. The woman has rigged up her loom in front of her house; she is busily employed in her weaving and her child sits beside her. Standing up by the loom is an excellent figure of a Navajo. Indian wearing the dress of the daily costume of the men of his tribe (See Plate xx.)

Navajos rear their own sheep, spin their own wool, manufacture their own dyes, and, as we have seen, weave their own blankets. And surely it is a sight not easily forgotten to see one of these superbly colored and

woven fabrics coming off a loom made from undressed and unseasoned pieces of timber from the forest, at the hands of an Indian, the representative of a civilization so entirely primitive. European art has to be sure slightly affected this industry, but even to-day its influence is easily traced; and apart from this these *serapes* and belts as now made saw their origin among the aborigines themselves.

Among all the native weavers of the southwest the Navajos have no equals and are indeed far in advance of any of the others in this line of manufacture.

The weaver had constructed the subvertical, outside part of the frame of her loom of two trunks of small pine trees, averaging a little over 3 inches in diameter, and from which the bark was not removed. Parallel to each other, and placed about a yard apart, these she had fixed in a slanting position against the front of her house outside. The upper ends were strapped to the house, and the lower ends slightly planted in the earth, being held more secure there by a few stones. Next she had firmly tied on cross pieces, a double one a few inches from the top, and a single one at about a foot above the ground. Over these cross pieces the warp passes, and in such a manner as to produce a double shed only. Then a smooth short rod is made to take up the alternate threads of the warp above the intersection or in the upper shed. This is easily seen in the engraving. Below the intersection of the threads of the warp the weaver serves the lower shed with a set of healds, which are usually composed of yarn, have their own rod, and as in the case of the rod above the intersection, include alternate threads of the warp. When drawn towards the weaver these healds serve the purpose of opening the lower shed, and still another short rod is used to keep the threads in place, which is also well seen in the figure, where the woman has her hands resting upon the batten, a smooth, flat, and rather narrow piece of hard wood. This is the last and yet one of the most important adjuncts composing this primitive loom, and is used by the weaver in turning it horizontally to open the shed to admit the passage of the weft, and afterwards to pound the latter down firmly into its place as the weaving proceeds.

These belt-looms as in use among the Navajos are not always exactly alike in their construction; for we find in some of them that the side posts of the frame are omitted, and the upper cross piece is fastened to a tree, and the lower one served with a loop of rope through which the weaver passes her limbs and then sits down upon, thus holding the warp of her belt firm and tense by her own weight as she sits cross-legged afterwards at her work. Other modifications of this simple loom are also to be seen in the contrivances in use among the Zunians and other Pueblo tribes, and the reare a number of departures from the main details of the weaving (also to be noted) as we have described them above.

Nearly all the belts and the blankets manufactured by these tribes

are made by their women, though it is not difficult to find among them also most excellent male weavers, and a very elegant blanket I once secured from the Navajos was made by a man, and its weaving took him considerably over a month to accomplish. A good belt can usually be bought for about \$12.

Curves are never found in the figure patterns on the belts or blankets, but the employment of horizontal stripes, the diagonals, and the lozenge are interwoven with a variety that appears to be almost endless in the matter of design. The leading colors used are red, brilliant orange yellow, a blue, and by combination a green, and finally black, white, and gray.

The manufacture of these dyes is an exceedingly interesting process, but its description does not properly fall within the scope of the present article.

As civilization advances westward and makes intrusion into the haunts of these simple people these aboriginal industries of theirs must eventually die out rather than be stimulated and enhanced by the contact. For with it civilization brings bright and cheap dyes of many shades; excellent Germantown wools that are not expensive; but more fatal than any of these, very good and durable blankets, of bright tints, that may be purchased by these Indians for a few dollars at the store of the trader, and thus obviate the tedious necessity of any further manufacture of their own in the future.







THE NAVAJO BELT-WEAVER.



## ON THE GENERA LABRICHTHYS AND PSEUDOLABRUS.

BY

THEODORE GILL, M.D., PH.D.

### I.

The most characteristic genus of Labrids of the southern hemisphere—at least with reference to its number of representatives—is that which is generally known as *Labrichthys* (but which is very different from the type properly so called) and whose proper name is rather *Pseudolabrus*. That the two types or groups of species are entitled to generic rank it is proposed now to demonstrate. The fact that the confusion of the two genera has lasted for nearly thirty years, and that the erroneous name is constantly being used for some of the most common fishes, is sufficient to justify a present protest, which is not timely simply because it ought to have been made years ago.

### II.

In 1854 Dr. Bleeker established a new genus, named *Labrichthys*, for a peculiar fish obtained from the island of Floris.\*

In 1861 Dr. Bleeker defined a genus called *Pseudolabrus* typified by *Labrus rubiginosus* of Temminck and Schlegel, a fish occurring in Japanese seas.†

So different did these two genera appear to be to their distinguished nomenclator that he widely separated them, and referred them to distinct subfamilies in his system, *Labrichthys* being regarded as the type of one subfamily (*Labrichthyiformes*) while *Pseudolabrus* was taken as the type of another subfamily (*Pseudolabryformes*).‡

The *Labrichthyiformes* were especially distinguished by the linear hypopharyngeal.

The *Pseudolabryformes* have a normal labroid hypopharyngeal.

In 1862 Dr. Günther combined the two genera under the common designation *Labrichthys*, and justified it by the following comment: §

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\* Bleeker, Nat. T., Ned. Ind., v. 4, p. 332.

† Bleeker, Proc. Zool. London, 1861, p. 415; Versl. K. Akad. Wet., XIII, 101.

‡ The *Cossyphiformes* were separated on account of the more numerous (10-13) dorsal spines and paved pharyngeals.

§ Günther Cat. Fish B. M., v. 4, p. 112.

Bleeker has established the genus *Labrichthys* for *L. cyanotenia*, and distinguished it from *Pseudolabrus* (*rubiginosus*) by the single series of teeth in the lower pharyngeal: *L. celidota* has two series; *L. tetrica*, *L. rubiginosa*, and *L. luculenta* have three. All these series are very irregular and form rather a band or a patch.

In 1863 Dr. Bleeker aptly met this comment: \*

M. Günther a mal compris mon genre *Labrichthys*, qui est très-différent du genre *Pseudolabrus* et qui s'en distingue non seulement par un autre type du système dentaire pharyngien, mais aussi par un système d'écaillure fort différent de la tête et des nageoires, par une construction différente de la lèvre inférieure, etc. Si M. Günther avait connu mon espèce type du genre *Labrichthys* (*Labrichthys cyanotenia*) il ne serait probablement pas tombé dans cette erreur. Cependant j'ai nettement précisé les caractères des deux genres, mais M. Günther n'y a pas fait attention puisqu'il dit tout simplement (Cat., p. 112): "BLEEKER has established the genus *Labrichthys* for *L. cyanotenia*, and distinguished it from *Pseudolabrus* by the single series of teeth on the lower pharyngeal."

As Dr. Bleeker claimed, it was not his fault that the two genera were confused and should continue to be so for nearly thirty years more.

No more than Dr. Günther in 1862 have I been able to examine a specimen of the typical *Labrichthys*, but the description and figure of Bleeker compared with specimens of *Pseudolabrus* plainly show how different the two are. Those differences, susceptible of clear definition, are contrasted in the following table :

## III.

LABRICHTHYS.	PSEUDOLABRUS.
Lateralis mostly tubular on each scale.	Lateralis ramose on each scale.
Frontal contour arched and elevated above eyes.	Frontal contour nearly straight, and not elevated above eyes.
Forehead scaly.	Forehead naked.
Operculum and suboperculum expanded backwards.	Operculum and suboperculum not expanded.
Preoperculum scaly.	Preoperculum naked.
Branchiostegites 5.	Branchiostegites 6.
Dorsalis and analis with deep scaly sheaths.	Dorsalis and analis without deep scaly sheaths.
Ventralis with first ray elongate.	Ventralis with second ray slightly longest.
Lips fimbriated; † lower especially developed in front.	Lips fimbriated; lower not developed in front.
Teeth. ‡	Teeth distinct, uniserial except for an inner rudimentary row, generally with posterior canines. ‡
Hypopharyngeal linear, with the anterior shaft atrophied, and with uniserial teeth. §	Hypopharyngeal normally labroid with the anterior shaft well developed, and with two or more rows of teeth.

\* Bleeker, Versl. en Med. K. Akad. Wet. (Amsterdam), Afd. Nat., v. 15, p. 444; Ned Tijds. voor Dierkunde, v. 2., p. 69, 1865.

† Ambo labia in vela fimbriata ast indivisa producta. K. & S., LIV, 394.

‡ In utraque maxilla lamina dentalis Scari ad instar, solum 4 dentibus caninis partim sejunctis, dentes angulares canini supramaxillares liberi. K. & S., LIV, 394.

§ Osse pharyngeali inferiore corpore gracili angulata dentibus conicis uniserialis. Bleeker, o. c., 154.

Certainly there are no two closely related genera of Labrids that are differentiated from each other by more numerous characters than thus become apparent between *Labrichthys* and *Pseudolabrus*. Direct comparison of specimens of the two genera would doubtless reveal others. Especially significant are the differences in the contour of the head and the relative proportions of the opercular apparatus, for they doubtless indicate decided osteological deviations. Far more important are the discrepancies between the two than such as exist between *Semicossyphus*, *Trochocopus*, *Decodon*, *Pteragogus*, and *Cossyphus*, for those genera are very closely related, and the cranial differences between most of them\* are unimportant. The differences in the hypopharyngeal appear to be so great that Bleeker was probably justified in referring them to different subfamilies.

On the one hand, the hypopharyngeal of the *Labrichthyinae* seems indeed to be anomalous, judging by the illustration of that of *Diprotacanthus xanthurus*. This is represented as linear and almost semicircular, destitute of an anterior shaft and with the short row of teeth confined to the convex median portion. So divergent is such a form from that exemplified by Labrids generally that corroboration of the figure is much needed, as well as explanation how the bone is connected with the preceding branchial arch.

On the other hand, the hypopharyngeal of *Pseudolabrus* is quite typical; it has the usual long compressed anterior shaft and moderately wide surface studded with teeth; in fact, it is essentially similar to that of the typical *Cossyphiformes* and *Pseudolabrifformes*.

The lips of *Pseudolabrus* are probably even much more different from those of *Labrichthys* than appears from the notices by Bleeker and by Kner and Steindachner of those of the latter.†

The structure of the lips indeed furnishes excellent data for diagnosis of many genera of Labrids. *Pseudolabrus* differs much from the typical *Cossyphiformes* in its lower lip. The upper lip is everted and obliquely multiplicate, and the inner plicæ are villous at their margins. The lower lip is double, the outer being everted and developed as plain lobes on each side, widely separated at the chin, while the inner is erect and has a villous margin, which is free from the jaw as well as from the outer lip all around.

#### IV.

I have thus far discussed the questions at issue on the assumption that any further complications of the subject were unknown, and this assumption is probably not illegitimate, so far as most authors who have treated of the fishes under consideration is concerned. Indeed,

\* I have not been able to examine the crania of *Semicossyphus* and *Pteragogus*.

† *Labrichthys cyanotaenia* has lips thus described by Bleeker (Atlas Ich. Ind. Ned., I, 154):—"labii latis carnosis, inferiore bilobo lobis fimbriatis." The diagnosis of Kner and Steindachner has been given on a previous page.

Dr. Günther, in "An Introduction to the Study of Fishes" (1880), and in the later German translation, "Handbuch der Ichthyologie" (1886), retained the same arrangement of the Labrids as that proposed in 1862, adding no other genera, and suppressing or ignoring one (*Callyodontichthys*).<sup>\*</sup> But there is much more to be taken into account.

In 1864, Professor Kner described a fish from the Samoa Islands with both lips having a fimbriated margin under the new generic and specific terms *Thysanoecheilus ornatus*.<sup>†</sup>

In 1866, Drs. Kner and Steindachner made known another fish from the Samoa Islands, also having both lips produced and with a dentition simulating that of the scarids under a new generic and specific designation, viz, *Chærojulis castaneus*.<sup>‡</sup>

*Thysanoecheilus* was supposed to be "most nearly allied to *Labrichthys cyanotænia* Bleek (Atlas I, Tab. 22, Fig. 1), but "in this the lower lip only is fringed, and there is only one canine in the upper jaw, at the angle of the mouth," etc.

*Chærojulis* was supposed to agree with *Thysanoecheilus* generally and in lip structure, but to differ in dentition.

The supposed differences between the several genera in question were subsequently negatived, and *Labrichthys*, *Thysanoecheilus* and *Chærojulis* were identified as generically identical and even based on the same species.

In 1867, Dr. Steindachner, having obtained a better preserved specimen of *Chærojulis castaneus*, recognized its identity with *Labrichthys cyanotænia* in the following terms:

*Chærojulis castanea*§ Kn. Steind. . . . ist, wie ich mich aus der Untersuchung eines später eingesendeten grösseren und besser erhaltenen Exemplares überzeugte, identisch mit *Labrichthys cyanotænia* Blkr. Die Bezeichnung der Kieferstücker und die Lippenbildung ist bei dieser Art so wesentlich verschieden von der übrigen *Labrichthys*-Arten, welche Günther im Cataloge der Fische des brit. Museums anführt, dass ich sie nach Bleeker's Vorgange in das Geschlecht *Pseudolabrus* vereinige, für welche Günther's Charakteristik des Geschlechtes *Labrichthys* Günth. (nec Bleeker) Anwendung findet, während das Geschlecht *Labrichthys*=*Chærojulis* Kn. Steind. zuerst von uns genau geschildert wurde.||

\* The only extralingual deviation between the English (1880) and German (1886) editions of the Introduction relates to *Crenilabrus*, viz: 1880, p. 527: "The range of this genus is co-extensive with *Labrus*. *C. melops*, the 'Gold-sinny,' or 'Cork-wing' is common on the British coasts." 1886, p. 376: "Die Verbreitung dieser Gattung fällt mit der von *Labrus* zusammen. Von den dreizehn bekannten Arten sind die meisten besonders im Mittelmeere gemein."

† Denkschr. Ak. W. (Wien), v. 24, p. 4; A. M. N. H., (3), v. 15, p. 77.

‡ S. B. Ak. W. (Wien), 1 Abth., v. 54, p. 393-395, previously (p. 377) noticed as "*PlatyGLOSSUS ocellatus* ? n," and described under caption "Zusatz nach *PlatyGLOSSUS chrysotænia*" (p. 393).

§ *Ch. castaneus*, K. & S., LIV, 394.

|| Steindachner's Ichthyologische Notizen (VI). < S. B. Ak. Wiss. (Wien), LVI, 332, 1867.

In 1869, Dr. Günther, having received a specimen of Labroid identified with *Labrichthys* by Col. Playfair, in a note ("Addendum") to a short article on fishes collected by him at Zanzibar, announced the following conclusions :

Colonel Playfair has sent to the British Museum an example of a small *Labroid* fish, which he regarded as a new species of *Labrichthys*, requesting me to examine it also. It proves to be identical with *Labrichthys cyanotænia* of Bleeker, but it would have been difficult to recognize it from Bleeker's description, as he has omitted to say that the ground-color of examples preserved in spirits changes into black. Beside an example sent by Dr. Bleeker as *L. cyanotænia*, the British Museum possesses an example of *Thysanochilus ornatus* of Kner. This I find is identical with the Zanzibar fish, although it appears really to be the type of a distinct genus closely allied to *Labroides*, for which the name proposed by Kner ought to be retained. The synonymy is:—

*Thysanochilus cyanotænia*.

*Labrichthys cyanotænia* Blkr.

*Thysanochilus*\* *ornatus* Kner.

Samoa Islands, Flores, Zanzibar.

Specimens in the British Museum :

a. 6½ inches long. Samoa Islands. Type of *Th. ornatus*.

b. 3½ inches long. Flores. (*L. cyanotænia*.)

c. 3½ inches long. Zanzibar.

It is thus seen that the generic distinctness of *Labrichthys cyanotænia* from the other species associated with it was here conceded by Dr. Günther, and the questions at issue are now reduced to one of nomenclature only! The subsequent omission of *Thysanochilus* in the "Introduction" and "Handbuch" was doubtless unintentional, and simply due to forgetfulness or want of research. Dr. Günther proposed to supersede the name *Labrichthys* of Bleeker by *Thysanochilus* of Kner, and to retain the name *Labrichthys* of Günther for the bulk of the species previously erroneously confounded with *Labrichthys* of Bleeker. A more wanton disregard of the principles of nomenclature could scarcely be imagined. *Labrichthys* was instituted for the *L. cyanotænia* and for that alone,† and the terms of the diagnosis (Caput, regione oculo-maxillari excepta, totum squamosum. . . . Præoperculum edentulum ubique squamosum. . . . Pinnæ verticales squamosæ. Membrana branchiostega 5) effectually excluded the species subsequently added to the genus; it was instituted in 1854, and *Thysanocheilus* was not introduced till 1872. The only reason, then, (except thoughtlessness), that could have influenced Dr. Günther in his course was that he had committed himself by applying the former name to a large assemblage of other species. It is very improbable, however, with the facts now made known, that any others will hereafter be so influenced by the ovine propensity to follow a leader as to longer follow him in such a course.

\* Kner wrote *Thysanocheilus*.

† It was suggested that *Labrus pæcilopleura* CV. might belong to the genus.



## V.

The history of the two genera may be summarized in the synonymy.

## LABRICHTHYS.

=*Labrichthys* Bleeker Nat. Tijd. Ned. Ind., v. 4, p. 331, 1854.

<*Labrichthys* Günther Cat. Fishes B. M. v. 4, p. 112, 1862.

=*Thysanochilus* Kner Denksch. Akad. Wiss. (Wien), v. 24, p. 4. 1865.

=*Chærojulis* Kner & Steind. Sitzungsber. K. Akad. Wiss. [Wien], i. Abth., v. 54, p. 393, 1866 (not *Chærojulis* Gill, 1862).

=*Labrichthys* Steind. Sitzungsber. K. Akad. Wiss. [Wien], i. Abth., v. 56, p. 332, 1867.

=*Thysanochilus* Günther P. Z. S., 1869, p. 241.

Type: *L. cyanotænia* Bleeker.

## PSEUDOLABRUS.

=*Pseudolabrus* Bleeker, Proc. Zool. Soc. London, 1861, p. 415.

<*Labrichthys* Günther, Cat. Fishes B. M., v. 4, p. 112, 1862.

=*Labrichthys* Günther, 1869.

*Labrus* sp. Temminck & Schlegel, Richardson.

*Tautoga* sp. Richardson.

Type: *P. rubiginosus*=*Labrus rubiginosus* T. S.

## VI.

The species of or related to *Pseudolabrus* are very numerous in the temperate southern Pacific. Most of them appear to have all the characteristics above contrasted with those of *Labrichthys*, but a few deviate and have been isolated in distinct genera or subgenera. Three such genera or subgenera have been named, viz: *Pseudolabrus*, *Austrolabrus*, and *Eupetrichthys*.

## PSEUDOLABRUS.

*Pseudolabri* with dorsalis and analis naked and generally rounded behind, and ventrales obtuse, having the second ray somewhat longest.

The following species of *Pseudolabrus* were diagnosed by Dr. Günther under the name *Labrichthys*:

1. *P. celidotus* (G. IV, 113; G. 1876; fig. E and T., pl. 31, f. 1-5).

New Zealand, Australia.

2. *P. bothryocoemus* (G. IV, 114; fig. E. and T., pl. 31, f. 6-10).

Australia, New Zealand.

3. *P. peittaculus* (G. IV, 114; fig. E. and T., pl. 56, f. 7-10).

Tasmania.

4. *P. coccineus rubiginosus* (G. IV, 114; Steind. and D., 1857; fig. F. Jap., pl. 86, f. 1).

Japan, China.

5. *P. gayi* (G. IV, 115; fig. Gay Ich., pl. 8, f. 1).

Juan Fernandez.

6. *P. inscriptus* (G. IV, 115; fig. E. and T., pl. 56, f. 1, 2).

Norfolk Island, Raoul Island.

7. *P. laticlavus* (G. IV, 115, 507; G., 1867; fig. E and T., pl. 56, f. 3-6; McCoy, 1839, pl. 163).

Tasmania.

8. *P. luculentus* (G. IV, 116).

Australia, Norfolk Island.

9. *P. g ntheri* (G. IV, 507; DeVis, 1884, 879.)  
Australia.
10. *P. tetricus* (G. IV, 116, not Rich.; *L. biserialis* Klunz. 1872; (fig. E. and T., pl. 55, f. 1)  
Tasmania, Australia (south).
11. *P. parila* (G. IV, 117).  
Australia (west).
12. *P. gymnogenis* (G. IV, 117, 507, n. sp.; G., 1867; Steind., 1867).  
Australia, China.
13. *P. punctulatus* (G. IV, 118, n. sp.).  
Australia (Swan River).

Numerous species, or at least specific names, were subsequently added or confirmed, all being referred to *Labrichthys*, except *P. australis* and *P. richardsonii*, (St., 1866.)

*P. fucicola* (Rich., 1840; Hutton, 1873, 265).

New Zealand.

*P. ephippium* (Gthr., 1863, 116).

Victoria.

The species subsequently discovered were chiefly described in the following periodicals and works:

Sitzungsberichte der Akademie der Wissenschaften, (Wien), by Steindachner and Klunzinger.

Proceedings of the Zoological and Acclimatization Society of Victoria, by Castelnau.

Philadelphia Centennial Exhibition of 1876, Victorian Catalogue, containing article by Castelnau.\*

Comptes rendus de l'Academie des Sciences (Paris), by Sauvage.

Proceedings of the Linn an Society of New South Wales, by Macleay, DeVis, Ramsay, and Ogilby.

Proceedings of the New Zealand Institute, by Hutton.

Papers and Proceedings of the Royal Society of Tasmania, by Johnston.

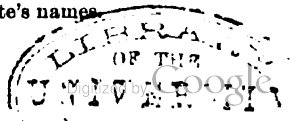
*P. australis* (Steind., 1866, 476).

Pacific Ocean.

*P. richardsonii* (Steind., 1867, 332, I. N. VI, 26; provisional name for species described as *P. luculentus* Rich var.)

Victoria.

\*The article of Castelnau is not mentioned either in the Zoological Record or the Archiv f r Naturgeschichte, and the references by Australian naturalists generally give no indication as to the manner of publication. It appears in the following work: Philadelphia Centennial Exhibition of 1876. (Melbourne, 1875.)—Official record, containing Introduction, Catalogues, Official Awards of the Commissioners, Reports and Recommendations of the Experts, and Essays and Statistics on the Social and Economic Resources of the Colony of Victoria.—Published by authority of the Commissioners. Melbourne: M'Carron, Bird & Co., . . . . MDCCCLXXV. [3 vo., + liv + 392 + viii, 255 + 19 + LII + v, 240 pp.] The "Researches on the Fishes of Australia" is separately paged (52 pp.), and contains descriptions (such as they are) of many supposed new genera and species. The newly named genera are *Neoniphon* (p. 4), *Breviperca* (p. 6), *Neomesoprion* (p. 8), *Aida* (p. 10), *Neolethrinus* (p. 11), *Neosillago* (p. 16), *Ellyria* (p. 21), *Pseudobatrachus* (p. 24), *Stenophus* (p. 26), *Neogunnellus* (p. 27), *Neoblennius* (p. 28), *Dampiera* (p. 30), *Neotherina* (p. 31), *Torresia* (p. 36), *Neoodax* (p. 37), *Othos* (p. 43), *Neorhombus* (p. 43), *Neoplotosus* (p. 45), *Blanchardia* (p. 47). The descriptions are worthy of the neophyte's name.



- P. tetricus* var. *tigripinnis* (Klunzinger, 1872, 37).  
Hobson's Bay.
- P. tetricus* var. *fuscipinnis* (Klunzinger, 1872, 37).  
Hobson's Bay.
- P. bleekeri* (Cast., P. Z. S. V., 1872, 148; McCoy, 1887).  
Victoria.
- P. richardsonii* (Cast., \* 1872, 150; 1873, 53; not *P. richardsonii* Steind).  
Victoria.
- P. restitus* (Cast., 1872, 151=ephippium G.)  
Victoria.
- P. cuvieri* (Cast., 1873, 53).  
Bass's Strait.
- P. bostocki* (Cast., 1873, 137).  
West Australia.
- P. edelensis* (Cast., 1873, 137).  
West Australia.
- P. unicolor* (Cast., † 1875).  
Victoria.
- P. ruber* = *L. rubra* (Cast., † 1875, 37; Klunzinger, 1880, 402).  
Victoria.
- P. convexus* (Cast., † 1875, 38).  
Victoria.
- P. lantzii* (Sauvage, C. R., 1875, 988; 1880, p. 37, pl. 2).  
St. Paul Island.
- P. isleanus* (Sauvage, 1875, 988; 1880, p. 39, pl. 3).  
St. Paul Island.
- P. cinctus* (Hutton, 1877, 354).  
New Zealand.
- P. nigromarginatus* (Macleay, 1878, p. 35, pl. 3, fig. 3).  
Port Jackson.
- P. biserialis* (Klunzinger, 1880, 402).  
King George's Sound.
- P. tetricus* var. *ocellatus* (Klunzinger, 1880, 402).  
Murray River.
- P. roseipunctatus* (Hutton, 1880, p. 455).  
New Zealand.
- P. dorsalis* (Macleay, 1881, 87).  
Port Jackson.
- P. labiosus* (Macleay, 1881, 88).  
Port Jackson.
- P. melanurus* (Macleay, 1881, 89).  
Port Jackson.
- P. rubicundus* (Macleay 1881, 89).  
King George's Sound.
- P. dux* (De Vis, 1883, 287; 1884, 47).  
Moreton Bay.
- P. cruentatus* (De Vis, 1884, 879).  
Moreton Bay.
- P. scolineatus* (De Vis, 1884, 880).  
Barrier Reef.
- P. rex* (De Vis, 1884, 880).  
Moreton Bay.

\*The "*Labrichthys Richardsonii*" was not identified with the "*Pseudolabrus Richardsonii*" of Steindachner, but described as a new species.

†The three species above enumerated are attributed by Macleay to Castelnau's "Researches on the Fishes of Australia."

- P. maculatus* (De Vis, 1884, 831).  
Moreton Bay.
- P. nudigena* (De Vis, 1884, 831).  
Barrier Reef.
- P. elegans* (Steind., 1883, 195).  
Gulf of St. Vincent.
- P. mortonii* (Johnston, 1835, 256).  
Tasmania.
- P. gracilis* (Steind. & Dod., 1887, 273).  
Japan.
- P. cyanogenys* (Ramsay & Ogilby, 1887, 242).  
Broken Bay, Australia.

Such are the specific names that have been proposed for various fishes of or related to the genus *Pseudolabrus*. That they are the symbols of as many species is quite another matter. It is probable that a considerable number represent variations in color or sexual characters or misapprehensions as to the meaning or significance of previous descriptions. Only an exact comparative study of specimens of all, or most at least, will enable a correct judgment to be formed on the subject. Such a study is one of the greatest desiderata of Australian ichthyology, and it is to be hoped that some one of the able naturalists of the southern hemisphere will undertake it and express his conclusions in *antithetical terms*, whereby the relative degrees of affinity as well as distinctive characteristics may be understood. So far as can be judged from the descriptions, almost all of the species are congeneric, but whether such is really the case can not be determined from the descriptions because many characters have been more or less neglected. The genus, with the limits still retained, however, does not appear to be a truly homogeneous one, and there are at least two sections which may be indicated, so that future study shall be directed to the value of the characters. We venture to indicate them here.

In the typical forms represented by almost all the Australian species the membrane behind the spines of the dorsalis and analis is penicilligrous. The name *Pseudolabrus* covers them.

In one species, the *Labrichthys laticlavus* of most authors, the membrane behind the spines of the dorsalis and analis is not produced. The name *Pictilabrus* may be used to denote it. *Pictilabrus* is not only peculiar in the absence of pencils or penicillia behind the dorsal and anal spines, for the head is also smaller, and more abbreviated than in the other species. If the meaning of the name *Pictilabrus* is demanded, imagination may play that the painting of the brilliantly colored fish has been completed and that the painter's brushes and pencils have disappeared. A component of two Latin words, as in the case of *Austrolabrus*, is also better than hybrids like *Labrichthys* and *Pseudolabrus*.

Other subtractions from the genus *Pseudolabrus* (as it would be recognized by many) have been made and they may provisionally be recognized as genera, and perhaps some fishes retained in the nominal list of *Pseudolabri* may belong to one or the other of them.

## AUSTROLABRUS.

*Austrolabrus* Steindachner, S. B. Akad. Wiss. [Wien], 1. Abth., v. 88, p. 1102 (Ich. Beit. XIII, 38), 1883.

*Pseudolabri* with dorsalis and analis covered with scales at bases and angulated behind, and with ventrals angulated and the first ray longest.\*

By Dr. Steindachner this type was considered to be at least subgenerically distinct from the *Pseudolabri*, on account of the scaly dorsalis, analis and caudalis.†

*A. maculatus* = "*Labrichthys*† (*Austrolabrus*) *maculata* Maccl." Steind. Australia.

## EUPETRICHTHYS.

*Eupetrichthys* Ramsay and Ogilby, Proc. Linn. Soc. N. S. Wales (2), II, 631, 1887.

*Pseudolabri* with dorsalis and analis naked and ventrals angulate and with the first ray elongate.

According to Messrs. Ramsay and Ogilby, "its close affinity to *Labrichthys* [*i. e.*, *Pseudolabrus*] is at once apparent, but in such a genus, where the fin formula remains constant throughout the whole series of about thirty§ species, any departure from the normal number must necessarily carry with it a greater weight than among fishes which enjoy greater latitude in this respect." This difference, therefore, coupled with the elongate ventrals and general form, || has induced the authors to propose the genus.

Only one species is known, viz: *E. angustipes* R. & O., 1887, 632. Port Jackson.

## VII.

It may be added that the *Labrichthys bicolor* of Day (Proc. Zool. Soc. London, 1870, p. 695) is the *Hemigymnus melapterus* of Bleeker as was later recognized by Day himself (F. I., 1877, 396).

\* *A. maculatus* has D. IX+12, A. III+10.

† Durch die starke Beschuppung der Dorsale, Anale und Caudale unterscheidet sich die hier beschriebene Art so auffallend von der Mehrzahl der übrigen *Labrichthys*-Arten, dass sie mindestens als Repräsentant einer besonderen Untergattung (*Austrolabrus m.*) betrachtet werden muss.—STEINDACHNER.

‡ I can only account for the use by Dr. Steindachner of the name *Labrichthys* for this type by the supposition that in the long interval of time between his repudiation of the name and the description of the new species he had forgotten his former conclusions (see p. 398). The facts certainly had not changed meanwhile, and no species intermediate between *Labrichthys* and *Pseudolabrus* had been discovered.

§ The examination of a more extended series of specimens will probably reduce this number somewhat.—R. & O.

|| *E. angustipes* has D. IX+12 and A. III+11, while typical *Pseudolabri* have D. IX+11 and A. III+10. "The greatest height of the body, which is behind the origin of the anal fin," is contained in the total length  $5\frac{1}{2}$  times, while the head is 5 times.

## DESCRIPTION OF A NEW SCINCOID LIZARD FROM EAST AFRICA.

BY

LEONHARD STEJNEGER.

*Curator of the Department of Reptiles and Batrachians.*

***Lygosoma kilimensia*, sp. nov.**

**DIAGNOSIS:** Limbs pentadactyl, short, distance between them when adpressed to side of body more than length of hind limb, the latter being much less than half as long as its distance from the axilla; distance from snout to fore limbs contained more than twice in the distance between axilla and groin; lower eyelid scaly; ear-opening an oblique slit, much larger than nostril; no supranasals; rostral forming a broad suture with frontonasal; prefrontals small and widely separated; frontal not broader than supraocular region; two frontoparietals; parietals forming a suture behind the interparietal; 24 scales round the body; toes not compressed; fourth toe longer than third; 13 to 15 lamellæ under fourth toe.

**HABITAT:** Kilima-njaro, East Africa.

**Type:** U. S. National Museum, No. 16749. Dr. W. L. Abbott coll., 1889.

**Description of type specimen.**—Body much elongate; limbs very weak; the distance between the end of the snout and the fore limb is contained twice and a half in the distance between axilla and groin; snout very short, obtuse; lower eyelid scaly; rostral wide, low, its posterior outline, as seen from above, straight; nostril pierced in the nasal; no supranasal; frontonasal more than twice as wide as long, forming sutures anteriorly with the rostral and posteriorly with the frontal, the width of each suture being greater than the length of the frontonasal; prefrontals small, widely separated; frontal short, as long as the frontoparietals, in contact with first and second supraoculars; five supraoculars; seven superciliaries; frontoparietals two, each larger than interparietal; parietals forming a suture behind interparietals; two pairs of nuchals; supralabials separated from orbit by a row of small scales, fourth supralabial being directly under the center of the eye; ear-opening narrow, oval, only slightly oblique to line of commissure; 24 smooth subequal scales round middle of body; one pair of somewhat enlarged anals, adjoining scales only slightly larger than rest; digits short, cylindric, terminal scale rather large, vaulted nail-like, nearly concealing the claw;

third finger a trifle larger than fourth, both with five scales above; fourth toe a little longer than third, with thirteen to fifteen smooth lamellæ underneath and seven scales above; third with six scales above; tail thick, long, all the scales subequal; color uniform brown above, pale buff underneath, with dusky longitudinal spots down the centers of the lateral scales, forming more or less continuous grayish lines on the flanks and sides of tail.

*Measurements (in millimetres).*

Total length (end of tail reproduced)	158	Snout to vent .....	68
Snout to posterior end of parietals..	9	Axilla to groin.....	45
Greatest width of head .....	7.5	Fore limb .....	10
Snout to fore limb.....	18	Hind limb.....	15

DESCRIPTION OF A NEW SPECIES OF LIZARD FROM THE ISLAND  
SAN PEDRO MARTIR, GULF OF CALIFORNIA.

BY

LEONHARD STEINEGER,

*Curator of the Department of Reptiles and Batrachians.*

*Cnemidophorus martyria*, sp. nov.

**DIAGNOSIS:** Dorsal scales equal; nostril anterior to nasal suture; frontoparietals distinct; nasal not in contact with second supralabial; eight longitudinal rows of ventral plates; femoral pores twenty; supraoculars four; three large preanals; caudal scales slightly oblique; scales on collar rather small, gradually decreasing in size toward the edge; under side of forearm without enlarged scales; no freno-orbital; frontonasal wider than long; head depressed, snout long and narrow; color above slaty black, with irregular, pale drab variolations; head more brownish, uniform; entire under side uniform blackish slaty.

**HABITAT:** San Pedro Martir Island, Gulf of California.

**Type:** U. S. National Museum, No. 15620. Dr. Edw. Palmer coll.

This species is quite characteristic by its coloration alone, for the combination of the variolated upper surface with the uniform blackish under side is, I think, quite unique. There is not even a trace of a linear arrangement of the pale markings, and what is still more remarkable even the very young specimen (head and body 39 millimetres) is without even the slightest indications of such a pattern.

**Description of type specimen.**—Head depressed; snout narrow and pointed; rostral narrow, pointed, posterior angle on top of snout long and acute; nostril in lower part of nasal; frontonasal wider than long, nearly straight anteriorly; prefrontals with the anterior external angle very acute and elongated; anterior angle of frontal well forward, nearly in line with anterior angle of first supraocular; four supraoculars, the posterior minute; last three supraoculars separated from supraciliaries by a row of granules; two frontoparietals; three parietals; postnasal in contact with first, second, and third supralabials; loreal large; no separate freno-orbital; central gular scales but slightly larger than the rest, followed by a wide band of very minute scales which extend to the edge of the collar, only the central mesoptychial scales being somewhat larger; dorsal granules small, smooth; ventral plates in eight longitudinal and about thirty-five transverse rows; three large preanals



forming a triangle, the two sides of which are bordered by a series of scales considerably larger than the surrounding granules; enlarged brachials in four nearly equal rows continuous with antebrachials, the latter in three rows, outer much the largest; twenty femoral pores; caudal scales slightly oblique, carinated.

*Measurements (in millimetres).*

U. S. Nat. Mus. No.	Collector.	Locality.	Total length.	Snout to collar.	Width of head.	Snout to interparietal.	Width at post. corner of supraoc. reg.	Snout to fore limb.	Collar to vent.	Fore limb.	Hind limb.	Vent to end of tail.	Remarks.
15620	Palmer ...	I. S. Pedro Martir.	.....	20	7.5	11	6	23	39	22	25	...	Type
15621	...do .....	...do .....	130	14.5	6.5	8.5	5	16	24.5	14	27	91	

The two specimens in the Museum were collected by Dr. Edward Palmer on the island San Pedro Martir (not Martin, as so often written!), a small island in the Gulf of California about equidistant from the mainland and the eastern coast of the peninsula of Lower California, and about half way between the upper end and the mouth of the Gulf.

DESCRIPTION OF A NEW NORTH AMERICAN LIZARD OF THE  
GENUS SAUROMALUS.

BY

LEONHARD STEJNEGER.

*Curator of the Department of Reptiles and Batrachians.*

*Sauromalus hispidus*, sp. nov.

**DIAGNOSIS.**—Nuchal scales spiny, the larger ones almost as large as the largest preauricular spines; dorsal scales ending posteriorly in a long, obtuse spine; dorsal scale rows average 16 to a head length; number of ventral scale rows from gular fold to anus averages 118; number of scales around thickest part of tail averages 50; femoral pores 12 to 15; size very large: total length of four specimens averages 540 millimetres.

**HABITAT.**—Angel de la Guardia Island, Gulf of California.

**Type.**—U. S. National Museum No. 8563. Dr. Thos. H. Streets coll.

*Synonymy.*

1877.—*Sauromalus ater* STREETS, Bull. U. S. Nat. Mus., No. 7, p. 36 (*nec* DUMÉRIL).  
TOWNSEND, Proc. U. S. Nat. Mus., XIII (No. 800) 1890, p. 144.

**Description of type specimen.**—Habit very stout, head depressed, body less so; nostrils large, tubular, opening upwards and outwards; upper head-scales large, considerably larger than the supraoculars, those of the parietal region largest, tubercular, some nearly conical; three series of strong conical scales in front of ear; several series of large conical tubercles on side of basal half of mandible; neck above very rough, covered with large but obtuse spines, most of them fully as large as the anteaauricular denticulation, and descending on the postauricular fold, sending a strong branch forward, nearly connecting with the mandibular spines; dorsal scales large, 16 in a head length, ending posteriorly in an obtuse spine, even the smaller scales above and back of the arms being spiny; ventral scales smaller and smoother, but the outer posterior corners somewhat projecting and pointed, about 118 scales in a line from anal opening to gular fold; scales on limbs large, about the size of those on nape, carinated and obtusely spinose; femoral pores very large, 13 on each side; scales on tail in verticils, large, about 44 in a verticil round the thickest portion at base, on the

upper surface carinate and strongly spinose behind. Color (in alcohol) apparently uniform brownish olive, though in life they are said to be "marked with one, two, or three large, rounded, or irregular grayish blotches somewhere on their body." (Streets *l. c.*)

In addition to the type specimen I have before me three others nearly as large, collected by Mr. Charles H. Townsend in the same locality. They agree in all essential characters with the type, some of the details and measurements (in millimetres) being found in the following table:

*Sauromalus hispidus.*

U. S. Nat. Mus. No.	Collector and No.	Locality.	Date.	Dorsal scale rows in head length.	Ventral scale rows, anus to gular fold.	Scales round thickest part of tail.	Femoral pores.	Total length.	Length of tail.
8563	Streets .....	Angel Isl., Gulf of Cal.	.....	16	118	44	.....	585	285
15873	Townsend, 24 .....	.....	Mar. 29, 1889	19	116	55	.....	532	275
15874	.....do.....	.....do.....	.....do.....	15	113	43	.....	562	282
15875	.....do.....	.....do.....	.....do.....	14	126	53	.....	462	240
Average of four specimens .....				16	118	49	.....	.....	.....

This enormous lizard is closely allied to the much smaller species which inhabits the arid regions on the mainland to the north of the Gulf of California, viz, *Sauromalus ater*, with which it has been confounded, but is readily distinguished by the characters given in the above diagnosis. In order to better emphasize the differences I herewith give the corresponding diagnosis of the old species.

*Sauromalus ater* DUM.

DIAGNOSIS.—Nuchal scales tubercular, or smooth, none of them half as large as largest preauricular spines; dorsal scales squarish, smooth, without any spine; dorsal scale rows average 32 to a head length; number of ventral scale rows from gular fold to anus averages 165; number of scales around thickest part of tail averages 76; femoral pores 15 to 18; size medium: total length of four adults averages 314 millimetres.

HABITAT.—Desert regions of southern California and southwestern Arizona.

Type.—In Muséum d'histoire naturelle, Paris, France. Locality unknown. Lieut. Jaurès coll.

*Synonymy.*

1856.—*Sauromalus ater* A. DUMÉRIL, Arch. Mus. d'Hist. Nat., VIII, p. 536, pl. xliii, figs. 3, 3a.

1858.—*Euphryne obesus* BAIRD, Proc. Phil. Acad. 1858, p. 253.—*Id.*, U. S. and Mex. Bound. Surv., II., Zool. Rept., p. 6, pl. xxvii (1859).

For comparison with *Sauromalus hispidus* I give the following table of details and measurements:

*Sauromalus ater*.

U. S. Nat. Mus. No.	Collector and No.	Locality.	Date.	Dorsal scale rows in head length.	Ventral scale rows, anus to gular fold.	Scales round thickest part of tail.	Femoral pores.	Total length.	Length of tail.
12264	Möhlhausen	Yampai Valley	.....	29	162	78	4	388	203
4172	Thomas	Fort Yuma, Ariz.	.....	28	182	73	3	302	140
11810	Möhlhausen	Colorado River	.....	34	161	72	3	313	153
16503	Orcutt	San Diego County, Cal.	Apr., 1889	31	160	77	3	253	125
11810 juv.	Möhlhausen	Colorado River	.....	37	*160	*80	3	180	85
Average of five specimens				32	165	76	.....	.....	.....

\*About.

In all probability the young of *Sauromalus hispidus* is much less spiny than the old ones, but the scales would be much larger than in corresponding specimens of *S. ater* and their number consequently smaller.

There is in our collection a medium-sized specimen of a *Sauromalus* collected by Mr. L. Belding on Espiritu Santo Island, at La Paz, near the southern extremity of the peninsula of Lower California (U. S. National Museum No. 12633), the true position of which I am not yet prepared to state, as I do not know whether it is fully adult or not. It is smooth like *S. ater*, but the relative size of the scales is somewhat larger, though not so large as in *S. hispidus*. It would be very interesting to receive a series of specimens from that locality.

Mr. Belding also states (West American Scientist, III, April, 1887, p. 97) that he found a *Sauromalus* at Guaymas, Mexico, but not having seen a specimen I can say nothing as to its specific identity.

It has long been suspected that these huge lizards live on vegetable food, in fact, Dr. Streets' statement (*l. c.*) as to the nature of their excretæ made it almost certain, but, to remove all doubt, I had the stomach of one of the large specimens (collected by Mr. Townsend) opened, and Prof. W. B. Barrows, of the U. S. Department of Agriculture, had the kindness to submit the contents to one of the experts in that line for examination. He reports that the contents are exclusively vegetable and that the numerous seeds are those of a malvaceous plant, probably *Sphæralcea hastulata*.



NOTES ON AND LIST OF BIRDS AND EGGS COLLECTED IN ARCTIC  
AMERICA, 1861-1866.

BY

R. MACFARLANE, F. R. G. S.,  
*Chief Factor Hudson Bay Company.\**

When recently requested by President Charles N. Bell, of Winnipeg, to write a paper on Arctic breeding birds, for publication by the Historical and Scientific Society of Manitoba, I thought of including therein a similar reference to the collections made in ornithology and oölogy by the northern officers of the company subsequent to the year 1859, when Mr. Robert Kennicott, an able, amiable, and prematurely cut-off American naturalist, and representative of the Smithsonian Institution at Washington, first appeared on the Mackenzie River. During his three years' sojourn in that quarter he managed to infuse into one and all with whom he had any intercourse more or less of his own ardent, zealous, and indefatigable spirit as a collector; but for want of space, time, and the requisite material I have had to abandon that idea, and must therefore confine myself to giving a résumé of what I was personally enabled to accomplish. I trust, however, that some day an abler hand will take the matter up, in its entirety, and publish a full account of the magnificent contributions to the natural history of the Dominion of Canada obtained by the exertions of Hudson Bay officers throughout the vast territories covered by the fur trade and commercial operations of their old company. Among those of their number who happened to be then, or about that time, stationed in the Mackenzie River district, and who thus rendered very essential service, may be mentioned Messrs. B. R. Ross, James Lockhart, Laurence Clarke, Wm. L. Hardisty, James McDougall, John Reid, C. P. Gaudet, Strachan Jones, J. S. Camsell, Murdo McLeod, James Sibbiston, A. McKenzie, Andrew Flett, W. J. McLean, William Brass and W. C. King. In this connection I would further add that, while the friendly and rather extensive correspondence carried on for years with many of the foregoing by the late eminent and much lamented Prof. Spencer F. Baird, of the Smithsonian, evinced his own deep love for science, it did much to intensify their interest in, and desire to meet more fully perhaps than was otherwise possible, the views and objects of that obliging and well-conducted Institution.

\* Formerly clerk in charge of Fort Anderson, Anderson River, Mackenzie River district, northwest territory of Canada.

The scope of country intended to be embraced within the above somewhat pretentious heading of "Arctic America" is bounded on the north by the Polar Sea to the eastern outlet of the Mackenzie River, on the east by the coast of Franklin Bay from Cape Bathurst to its depth in Langton Harbor, on the west by the Lower Mackenzie River, and on the south by the sixty-seventh parallel of north latitude to its intersection with longitude  $124^{\circ}$  W. It may, however, be mentioned that very few specimens indeed were gathered to the southward of  $67^{\circ} 30'$  N. and to the westward of longitude  $129^{\circ}$ , except from the Lower Anderson to the Mackenzie.

The period during which the following collections and observations were made extended from the beginning of April, 1862, to the end of June, 1866. No account is, however, taken of a box of specimens obtained in the summer of 1861 and presented to the late Chief Trader Bernard R. Ross. The principal scene of investigation was Fort Anderson (latitude  $68^{\circ} 30'$  N. and longitude  $128^{\circ}$  W. or thereabouts), established in 1861 for the Esquimau trade and abandoned in 1866. It was situated on the right bank of the Anderson River, first visited by me in 1857. This large stream, which disembogues itself into Liverpool Bay, has its sources in the Revd. Abbé Petitot's *Ti-Dégaldé* (Frost-hardened Mountain), lying at "some little distance" to the north of Great Bear Lake.

The tract of country in question may be briefly described as mainly flat, but intersected by several hilly ridges or heights of land, having the principal portion of its surface more or less densely covered with forest and diversified by gentle eminences, marshy spaces, and spots of peaty soil, many streams and numerous lakes and sheets of water, greatly varying in size. Beyond the sixty-eighth degree of latitude, however, trees become sparse and stunted, except along the ravines and banks of the larger rivers, where the fringe of timber soon rapidly narrows and disappears altogether in about  $69^{\circ}$  N. Thence to the coast and from the border of the woods to the southeast, begin those vast steppes, or undulating plains, which extend for hundreds of miles and are known as the "Barren Grounds." Fewer lakes and streams are there met with, while much of the country on the west side of the Anderson, near its outlet to the Mackenzie, is said to be devoid of wood, low, and comparatively more marshy than elsewhere; and we have then the shores and smaller islands and islets of Esquimaux Lake and the adjacent Polar Sea to finish this rather meager sketch. But, for all that, I do not believe that a field of equal extent, better adapted for the breeding purposes of so interesting and important a variety, from the Yellow Warbler to the Golden Eagle, among the land, to the Least Sandpiper and the Trumpeter Swan, among the water birds of North America, exists in any other part of the northwest territories of Canada.

If the scene of operations was rich and varied, it must be admitted

that the position held during those years and the opportunities thereby afforded for making a splendid collection were exceptionally good yet, owing to ignorance and a want of interest displayed, both by Indians and Esquimaux in the beginning, one or two rather unfavorable seasons, heavy annual losses of specimens by accidents and neglect, the almost total destruction by animals of our last spring's very small list, the death by epidemic, measles, and scarlatina of the majority of our best and most experienced native collectors, in the autumn and early winter months of 1865, and the abandonment of Fort Anderson in the summer of 1866, both of which last-mentioned adverse factors prevented me from spending the nesting season of that and the succeeding year, as I had intended, on the shores and in the neighborhood of Esquimaux Lake and Liverpool Bay, very much still remains to be done by future explorers, even in this comparatively small section of the Great Mackenzie Basin, before its fauna is satisfactorily, far less exhaustively, ascertained, and the result duly communicated to the scientific world.

It will be observed from the list which follows that comparatively few of the many other species of birds which indubitably occur within the aforesaid defined boundaries, and whose eggs were not discovered or received by us, are noted therein. The notes themselves are chiefly an abridgment of the relative text, which had been condensed or quoted from the copious memoranda furnished along with the specimens, as contained in that valuable and most interesting "History of North American Birds, by Messrs. S. F. Baird, T. M. Brewer, and R. Ridgway." The three volumes of the Land Birds were published in 1874, and the two of Water Birds in 1884, both by Little, Brown & Co., of Boston, Massachusetts. For the sake of conformity, however, to the canons of nomenclature, since adopted by the American Ornithologists' Union, their recently revised and abridged Check List will, be closely adhered to in the following classification.

## WATER BIRDS.

### 2. *Colymbus holboellii* (Reinhardt). Holboell's Grebe.

My notes record but two nests of this grebe, one contained four and the other five eggs, and both were found at a distance of some 40 or 50 miles south of Fort Anderson.

### 3. *Colymbus auritus* Linnæus. Horned Grebe.

A skin or two, but no eggs, were secured near Lockhart River in June, 1861, and forwarded to the late Mr. B. R. Ross, while a female parent with five eggs was taken on a nest on the edge of a small lake about 60 miles southeast of the post in June, 1866, but they were afterwards lost in the manner already alluded to. I should say that grebes were far from numerous, even in the southern portion of the Anderson country.



7. *Urinator imber* (Gunn.). Loon.

The nest of this diver is usually found in the water on the edge of a small lake, and is but a mere depression in the center of a tolerably large mass of turf, or accumulated decayed vegetable matter, partially secured from observation by grass and reeds growing thereon, or in its vicinity. In no instance were more than two eggs taken in any of the nine recorded nests.

8. *Urinator adamsii* (Gray). Yellow-billed Loon.

During the period of reproduction this loon abounds in considerable numbers in Franklin and Liverpool bays, where several examples were shot. It is also sometimes met with on the larger lakes of the interior. Although most anxious to possess eggs of this species, we all failed to discover even one well-authenticated nest, while it is possible that the two *adamsii* eggs referred to on page 452, of vol. II, of the aforesaid Water Birds of North America, may have belonged to the Great Northern Diver. An Esquimaux of our party observed a male *Somateria v-nigra* struck and killed on the wing by a bird of this species.

9. *Urinator arcticus* (Linn.). Black-throated Loon.

This species undoubtedly breeds within the Arctic circle; but we must have secured very few specimens, as I only know of one well-authenticated set of eggs, obtained from Fort Anderson in 1865, and which are now in the oölogical collection of the U. S. National Museum in Washington.

10. *Urinator pacificus* (Lawrence). Pacific Loon.

This is the most abundant of all the divers in the region under investigation. Nests were discovered in the wooded country, in the Barren Grounds, and on the shores and islands of the Arctic coast. In situation and composition they resemble those of *U. imber*. In all about one hundred and sixty-five nests, most of which contained two eggs, were secured in course of the five seasons, from 1862 to 1866, inclusive. Some eggs of this species, as well as of many other birds, also got broken on their way to the post and in course of emptying and handling them there. I may here remark that although the several members of the family *Urinatoridæ* occasionally give utterance to rather discordant sounds while in the water, the Pacific Loon is noted for its peculiarly loud, weird, and prolonged shrill scream during the season of nidification.

11. *Urinator lumme* (Gunn.). Red-throated Loon.

Although its yearly range in summer is equal to that of *U. pacificus*, it is the least numerous of the genus, and but some forty identified nests were found within the same period of time, and in the stated localities. Most of these also had two eggs, the maximum number laid by all loons according to native report and personal observation.

**36. *Stercorarius pomarinus* (Temminck). Pomarine Jaeger.**

In June, 1863, an Esquimaux brought in one jaeger, and in June, 1864, another man traded a male and female specimen, which he killed near the outlet of Anderson River. On 11th July, 1865, we shot a male bird in Franklin Bay. The first-mentioned is inadvertently stated in the aforesaid History of North American Birds to be the only example of the species procured, although the receipt of all of them was duly acknowledged by the Smithsonian Institution. We did not have the good fortune to become acquainted with its eggs.

**37. *Stercorarius parasiticus* (Linn.). Parasitic Jaeger.**

A more numerous bird than the former, especially in the Barren Grounds, where several nests were annually discovered on our collecting expeditions from Fort Anderson to Franklin Bay (1862 and 1865). A few specimens were also obtained from the Esquimaux of the Lower Anderson River. There is, of course, no darkness for several months in summer within the before defined Anderson section of the Arctic regions, while in June the sun at midnight is several degrees above the horizon. During the period, however, answering to the night in southern latitudes, we often observed in the "Barrens" and on the sea coast as many as twenty or thirty birds of the genus *Stercorarius* sitting or standing on the ground, each bird at the distance of a few yards from its fellow. They probably reposed at such times, as they never moved except when closely approached, while no eggs were ever discovered in the vicinity of these resting places. During the day, also, two or more birds were frequently noticed quietly reposing or moving very slowly along the ground, and this, too, where no nest actually existed.

**38. *Stercorarius longicaudus* (Vieillot). Long-tailed Jaeger.**

This handsome jaeger is quite abundant along the Anderson, in the "Barrens," and also on the Arctic coast. It lays two eggs in a depression in the soil, scantily lined with withered leaves and grasses, etc., and as their eggs greatly resemble their surroundings the nest is frequently very difficult to discover. The parent birds, by angry screams and hostile demonstrations, invariably resent the presence of intruders, and in more than one instance they became so savage in their attacks, especially the female, that she had to be shot at once in order to prevent actual injury. Over thirty nests were taken, or double as many as that of the foregoing. The several species of jaeger doubtless destroy a large number of other birds' eggs annually.

**42. *Larus glaucus* Brinn. Glaucous Gull.**

Altogether some twenty nests were gathered by our collecting parties, chiefly on sandy islets in the bays of Franklin and Liverpool, and a few of these were also found on islands on the Lower Anderson; but

the bird itself was observed in various localities. Fifteen of the nests contained two eggs each, and but five had as many as three. The nest was usually a shallow depression in the beach, while in one of them we discovered an egg of the Black Brant which was being incubated by a bird of this species. The egg of the goose was in a more embryo-developed stage than those of the gull, which we always considered as about the bravest of the *Laridæ* in defense of its eggs and young.

**43. *Larus leucopterus* Faber. (?) Iceland Gull.**

This species was not seen, or at all events no specimens found their way to Fort Anderson from Liverpool Bay; but several sets of the supposed eggs were procured on the shores of Franklin Bay early in July, 1863, and again in July, 1865.

**51a. *Larus argentatus smithsonianus* Coes. American Herring Gull.**

This gull is common on the Arctic coast, as well as along the Wilmot-Horton River (Barren Grounds), and a number of nests were discovered and the eggs secured in the referred-to localities, and also from islands on the Lower Anderson.

**53. *Larus californicus* Lawrence California Gull.**

Quite a number of specimens with eggs were received from the Lower Anderson Esquimaux, and one or two nests also were found on the margin of small lakes in the vicinity of the fort.

**55. *Larus brachyrhynchus* Richardson. Short-billed Gull.**

More numerous and widely diffused than the three preceding species. Its nest is usually a small cavity in the sand by the side of a stream or sheet of water; but it also frequently builds on a stump or tree, and in such cases dry twigs, hay, and mosses are used in its construction. A good many sets of eggs and birds were collected at Fort Anderson. The parents do their utmost to drive away intruders. On one occasion in the "Barrens" we wounded a male which a female *Stercorarius parasiticus* set upon as he fell into the water, evidently with no friendly intentions; but another shot killed both.

**59. *Larus franklini* Swainson and Richardson. Franklin's Gull.**

Although no example specimen was secured, yet I strongly incline to think that some gulls of this species breed within the before defined section of the Arctic regions.

**60. *Larus philadelphia* (Ord). Bonaparte's Gull.**

Thirty seven nests are recorded as having been taken with eggs in them, between 10th June and 10th July, in the wooded country in the neighborhood of Fort Anderson and on Lower Anderson River they

were all built on trees at various heights (from 4 to 15 and even 20 feet) from the ground, and, with one exception, which was composed of down and velvety leaves held together by some stringy turf, they were made of small sticks and twigs lined with hay and mosses, etc. The parents always fly about in close proximity to the nest and scream vehemently when explorers, in the interests of science, are obliged to deprive them of their eggs or young, and not infrequently shoot one of them. They seldom lay more than three eggs.

62. *Xema sabini* (Sabine). Sabine's Gull.

Quite a large number of nests were found on the shores of Franklin Bay, and a few eggs were also received from the Esquimaux of Liverpool Bay. Several specimens of this beautiful gull were shot at the former point. On the 1st July, 1864, we knocked over three out of a flock of sixty which came circling about our encampment; they then gracefully retired to and alighted in a pool of sea-water at a safe distance. One of the three having been merely stunned soon recovered, and after two ineffectual attempts made by an Indian to choke her, she again revived, and I set her at liberty. She flew away slowly to her friends, who received her no doubt with demonstrations of great joy, judging from the noise they made. After a few minutes they all took their departure, probably to their breeding grounds.

70. *Sterna hirundo* Linnaeus. Common Tern.

It breeds extensively on the shores of the Arctic Sea, as well as on islets in many of the inland lakes of the forest and "Barrens;" but although its eggs were not *desiderata*, and we did all we could to discourage their gathering, yet a large number were received for shipment to Washington.

71. *Sterna paradisea* Brinn. Arctic Tern.

This tern is equally common with the foregoing, and we might easily have made a considerable collection of eggs from various localities. Neither species approves of a close proximity of man to their nests.

129. *Merganser americanus* (Cassin). American Merganser.

I am strongly of the belief that this species breeds in small numbers in the country to the south of Fort Anderson, and that we received the eggs of one or two nests thereof, which were afterwards lost.

130. *Merganser serrator* (Linn.). Red-breasted Merganser.

Several nests of this not particularly numerous merganser were obtained in the vicinity of Fort Anderson, and also in the wooded parts on both sides of the river, north and south of the post. One was found on the border of the "Barrens" to the east under a fallen tree, close to

a small lake. It was a scooped-out hole lined with feathers and down and contained six eggs, with their contents in a partially embryo-formed condition; the female was snared on her nest. Ten was the maximum number of eggs found among the obtained specimens.

132. *Anas boschas* Linnæus. Mallard.

This abundant and widely distributed duck is to be met with almost throughout the entire wooded section of country under consideration. Examples were received from various points. It lays from six to eight eggs in a nest composed of down and feathers, placed in a hole or depression in the ground contiguous to small clumps or tufts of willow, etc

133. *Anas obscura* Gmelin. Black Duck.

Not uncommon on the Anderson River; but although several birds were shot, we failed to secure even one well authenticated nest of its eggs.

135. *Anas strepera* Linn. Gadwall.

Although we obtained no specimens of this duck or its eggs, we had reason to suppose that it breeds annually in that quarter.

137. *Anas americana* Gmel. Baldpate.

Numbers of nests were discovered in different places in the vicinity of Anderson River, and a few as well near Swan River, one of the principal affluents of the Wilmot-Horton Barren Grounds.

139. *Anas carolinensis* Gmel. Green-winged Teal.

This we found to be one of the rarest among our breeding ducks, and for that reason but one nest was secured near Fort Anderson. Like those of most of the teals, it was composed of feathers and down placed in a depression on a dry piece of ground close to a clump of willows.

142. *Spatula clypeata* (Linn.). Shoveler.

Very rare, and a couple only of specimens were collected at Fort Anderson during the five or six seasons we resided there.

143. *Dafla acuta* (Linn.). Pintail.

This and (this especially) the Long tailed Duck, I think, are the most numerous of the *genera* which annually resort to the Anderson and the Arctic coast, and they are also among the first to arrive in the spring. They were always abundant in the "Barrens." The nest was usually a small cavity or depression in the ground, lined with down, withered leaves, and a few feathers, and it lays from six to eight eggs. Both species desert their nests almost immediately after the young are

hatched, and take to the water with them. From frequent observation I feel convinced that they almost invariably select land locked sheets of water for the purpose of rearing their young, while most of the other species of ducks give the preference to running streams.

**147. *Aythya vallisneria* (Wilson). Canvas-back.**

A few sets of eggs of this famous duck were found in the vicinity of Fort Anderson, where it is tolerably abundant during the season of nidification. The American Scaup Duck, *A. marila nearctica* Stejn., is also believed to be a summer resident, but I do not think I ever found any of its eggs.

**149. *Aythya affinis* (Eyt.). Lesser Scaup Duck.**

Fairly numerous even to the very edge of the wooded country on the east side of the Anderson River. Over a dozen nests were secured—and they were usually found in the midst of a swamp—a mere hole or depression in the centre of a tuft of turf or tussock of grass, lined with more or less down, feathers, and hay. Nine was the general number of eggs in a nest, though a few contained no more than six or seven. *A. collaris* (Donovan) probably breeds in the same quarter.

**152. *Glaucionetta islandica* (Gmel.). Barrow's Golden-eye.**

Although an individual bird of this species was shot by Mr. Murdo MacLeod in the vicinity of Fort Anderson, on 29th June, 1863, and a male example obtained there on the 14th June, 1864, yet our best efforts failed to discover a single nest in that or any other quarter, and I think it may be classed among the rarest of ducks visiting that region. We never observed any specimens of the *G. clangula americana* (Bonap.), nor of the Buffle-head, *Charitonetta albeola* (Linn.), in the Anderson country.

**154. *Clangula hyemalis* (Linn.). Old-squaw.**

The Long-tailed Duck breeds in great numbers in the neighborhood of Fort Anderson, along the Anderson River, on the Barren Grounds, and on the shores of the Arctic Sea. Considerably over one hundred nests were taken, and the eggs varied from five to seven, the latter being the maximum number recorded in any one instance. In its make the nest is generally very similar to that of *Dafila acuta*. From personal observation, also, I have come to the conclusion that the usual quantity of down necessary for a duck's nest is seldom met with before a full set of eggs has been deposited, and that the process of lining with down, which is plucked off from the body of the female, goes on simultaneously with their laying. Thousands of "Old Squaws" were seen apparently feeding and otherwise disporting themselves in the waters of Franklin Bay. If present, it is rather surprising that we never came across a duck of the Harlequin species—*Histrionicus histrionicus*.

161. *Somateria v-nigra* Gray. Pacific Eider.

This interesting eider breeds in immense numbers on the shores of Franklin Bay; it is also very abundant on the coast and islands of Liverpool Bay. The nest is usually a shallow cavity in the ground, more or less plentifully lined with down. The eggs are generally five, and but rarely six and seven in number, of a pale sea-green color, "with a tinge of olive." We found some nests on a sloping bank at a distance of three hundred or more feet from the sea. Others were also on the main land, but the bulk of those secured by us were obtained from sandy islets in the bays. Over one thousand eggs of the *S. v-nigra*, I think first made known by us, were forwarded to Washington. The male bird is very wild and difficult of approach, especially after being once fired at. On one occasion we discovered a nest containing four eggs from observing a white owl engaged in eating them. Female birds appeared to be always largely in excess of males in the bay.

162. *Somateria spectabilis* (Linn.). King Eider.

Tolerably numerous in Franklin Bay, where an aggregate of some two hundred eggs were secured on the several summer (1862 to 1865) visits paid to that quarter. The nest is similar to that of the above eider, and when not disturbed the female usually lays from four to six eggs. In color they are generally of a light shade of olive gray, and some are of a grayish green. In addition to the eggs above mentioned the contents of about twenty nests were also received from the Esquimaux of Liverpool Bay. A few birds occasionally breed in close proximity to *S. v-nigra*, and the male is nearly as wary in keeping beyond gunshot.

163. *Oidemia americana* Sw. and Rich.. American Scoter.

This duck undoubtedly breeds in the Anderson River country, although we never succeeded in obtaining any authenticated specimens. There are also some other breeding water birds whose eggs have no doubt eluded discovery.

165. *Oidemia deglandi* Bonaparte. White-winged Scoter.

The Velvet Duck breeds in large numbers throughout the region under review, as several nests were found in the "Barrens," some near the Fort, a few on the Lower Anderson and in other parts of the wooded sections; these were always depressions in the ground, lined with down, feathers, and dry grasses, and placed contiguous to ponds or sheets of fresh water, frequently amid clumps of small spruce or dwarf willow, and fairly well concealed from view. The number of eggs found in a nest varied between five and eight.

166. *Oidemia perspicillata* (Linn). Surf Scoter.

The remarks made under *O. deglandi* happen to be, in almost every respect, equally applicable to the present species, the only difference noted being that generally less hay and feathers was observed in the composition of its nest, while only one contained as many as eight eggs, the usual number being from five to seven. Both Scoters were very abundant on the seacoast, especially the last mentioned.

169. *Chen hyperborea* (Pallas). Lesser Snow Goose.

The Esquimaux assured us that large numbers of "White Wavies" annually breed on the shores and islands of Esquimaux Lake and Liverpool Bay, but, strange to say, we never observed any in the Barren Grounds proper or on the shores of Franklin Bay. The Esquimaux brought in to Fort Anderson about one hundred eggs, which they claimed to have discovered among the marshy flats and sandy islets on the coast of the former, as well as from similar localities on and in the vicinity of the lake of that (Esquimaux) name.

169a. *Chen hyperborea nivalis* (Forster). Greater Snow Goose.

The foregoing remarks are also applicable to this goose, and, no doubt owing to both species having until lately been considered as mere varieties, there has been some mixing up of their eggs, a question which future explorations will doubtless solve. It is, however, believed that here, as well as on Lake Athabasca, the former precede the latter by some days in their arrival in spring. I have always regretted that I was unable to carry out my intention of devoting at least two seasons to a personal exploration of the breeding grounds of this and many other birds which resort to the so-called "Esquimaux Lake" and the shores of Liverpool Bay.

170. *Chen rossii* (Baird). Ross's Snow Goose.

A male bird of this species was shot at Fort Anderson on 25th May, 1865, where it is by far the least abundant of the genus during the spring migration. The Esquimaux assured us that it did not breed in Liverpool Bay, and it may therefore do so, along with the great bulk of the two larger species, on the extensive islands to the northwest of the American continent. At Fort Chipewyan, Athabasca, however, it is the last of the geese to arrive in spring, but among the first to return in the autumn.

171a. *Anser albifrons gambeli* (Hartlaub). American White-fronted Goose.

A considerable number of nests of this "Gray Wavy" was discovered in the vicinity of fresh-water lakes in timber tracts, as well as along the Lower Anderson River to the sea. Some were taken on the Arctic coast, and several also on islands and islets in Franklin Bay. In all



about one hundred nests were secured. The nest, which was always a mere shallow cavity in the ground, in every observed and reported instance had more or less of a lining of hay, feathers, and down, while the maximum number of eggs in no case exceeded seven. On 5th July, 1864, on our return trip from Franklin Bay, we observed thirty molting ganders of this species on a small lake in the Barrens. Our party divided, and by loud shouting and throwing stones at them they were driven to land, where twenty-seven of them were run down and captured. Their flesh proved excellent eating; it is seldom, indeed, that I have come across a Gray Wavy that was not in good condition in the far North.

**172. *Branta canadensis* (Linn.). Canada Goose.**

This well-known goose breeds throughout the entire wooded region of the Mackenzie Basin. Nests were discovered in the vicinity of Fort Anderson and to the borders of the forest on the east and west sides of the river of that name, but none were met with in the Barrens proper, nor on the Arctic Coast. Several deserted hawks' nests on trees were found occupied by incubating female birds of this species. We forwarded one hundred and seventy eggs of *B. canadensis* to the Smithsonian.

**172a. *Branta canadensis hutchinsii* (Sw. and Rich.). Hutchins's Goose.**

A large number (fifty) of nests of the smaller Canada Goose was found on the Lower Anderson, as well as on the shores and islands of the Arctic Sea. All but one were placed on the earth, and, like that of the preceding species, it was composed of hay, feathers, and down, while six was the usual number of eggs. The exceptional case was a female parent shot while sitting on four eggs in a deserted crow's or hawk's nest built on the fork of a pine tree at a height of about 9 feet. At the time, the ground in the vicinity thereof was covered with snow and water, and this may have had something to do with her nesting in so unusual a place.

**172b. *Branta canadensis occidentalis* (Baird). White-cheeked Goose.**

If no eggs were taken, it is almost certain that this large Canada Goose is to be met with occasionally at least, if not annually, on the Anderson, as we had methinks more than one undoubted skin or part thereof brought in during our residence there.

**174. *Branta nigricans* (Lawrence). Black Brant.**

This goose is exceedingly abundant on the Arctic coast of Liverpool Bay, but it is comparatively rare in Franklin Bay. Large numbers of eggs were obtained by the Esquimaux in the first mentioned, but hardly any in the latter locality. We never, however, observed any

of those birds passing the post on their usual spring and autumn migrations. Six hundred and fifty eggs were packed up for shipment from Fort Anderson.

**180. *Olor columbianus* (Ord). Whistling Swan.**

The maximum number of eggs taken in the twenty nests of this swan, which I find recorded, was five, while the nest itself was always placed on the ground, and several were also found on the coast and islands of Liverpool and Franklin Bays in the Arctic Ocean.

**181. *Olor buccinator* (Richardson). Trumpeter Swan.**

Several nests of this species were met with in the Barren Grounds, on islands in Franklin Bay, and one containing six eggs was situated near the beach on a sloping knoll. It was composed of a quantity of hay, down, and feathers intermixed, and this was the general mode of structure of the nests of both swans. It usually lays from four to six eggs, judging from the noted contents of a received total of twenty-four nests.

**204. *Grus americana* (Linnaeus). Whooping Crane.**

We never succeeded in finding a nest of this crane, which undoubtedly breeds in Arctic America as well as in the country to the southward, as a few flocks were observed flying past Fort Anderson both in spring and autumn.

**205. *Grus canadensis* (Linn.). Little Brown Crane.**

A skin was obtained from an Esquimau of the Lower Anderson in the autumn of 1863, and an egg was found in a nest in Franklin Bay in June, 1864. A second was discovered the following season on an island in Liverpool Bay, while the eggs (two each) and parents of two other nests, received from the Lower Anderson in the spring of 1866, were afterwards among those referred to as having been destroyed by animals. The nest is usually but a mere cavity in the sandy soil, thickly lined with dry grasses, etc.

**222. *Crymophilus fulicarius* (Linn.). Red Phalarope.**

This bird is fairly abundant on the shores of Franklin Bay, where nests were obtained amid marshy flats in the first week in July, 1864, and again in July, 1865.

**223. *Phalaropus lobatus* (Linn.). Northern Phalarope.**

Occurs in great abundance during the breeding season in the wooded country and in the Barren Grounds right to the coast, where it is, however, not numerous. The nest, like that of the Red Phalarope, is a slight depression in the ground, lined with a few dry leaves and grasses, and is almost invariably situated on the margin of small pools

or sheets of water. Upwards of seventy nests were secured, the number of eggs being always four. Although the parent usually left the nest, both birds would sometimes exhibit great uneasiness and utter loud cries of distress on the approach of man.

**230. *Gallinago delicata* (Ord). Wilson's Snipe.**

Not particularly numerous in the Anderson country, as we found comparatively few nests. I may here remark that the nests of all the snipes and sandpipers are much alike in composition, number of eggs, and situation.

**232. *Macrorhampus scolopaceus* (Say). Long-billed Dowitcher.**

The few nests of this species as recorded were taken between the 21st of June and the 1st of July, the eggs were always four in number, but it is not a very abundant bird in the Anderson section of the Polar regions. *M. griseus* (Gmel.) probably breeds in the same quarter.

**233. *Micropalama himantopus* (Bonap.). Stilt Sandpiper.**

The Stilt Sandpiper was fairly abundant on the shores of Franklin Bay, where a number of nests with eggs and young were discovered. It is, however, very rare in the interior, only one nest having been taken at Rendezvous Lake on the borders of the wooded country east of Fort Anderson. On one occasion we could not help admiring the courage and ingenuity displayed by both parents in defense of their young, which resulted in saving two of the latter from capture.

**239. *Tringa maculata* Vieill. Pectoral Sandpiper.**

We failed to discover any nests of this rather rare species. A few birds were seen flying past the Fort, and one or two were shot.

**240. *Tringa fuscicollis* Vieill. White-rumped Sandpiper.**

Several nests of this sandpiper were found on or near the Arctic coast of Franklin Bay. One of these taken July 3 contained four eggs with very large embryos. Another discovered on the following day held but three eggs. A third found in the Barren Grounds on 29th June was, like the rest, a shallow cavity in the ground, lined with a few decayed leaves, containing four eggs, also having very large embryos. A fourth, obtained on the banks of a small river, held four eggs whose contents were, however, in a far less developed condition than the others.

**241. *Tringa bairdii* (Cones). Baird's Sandpiper.**

On 24th June, 1864, a nest containing four eggs was found in the Barren Grounds, in a swampy tract between two small lakes, and was composed of a few decayed leaves placed in a small cavity or depression in the ground, shaded by a tuft of grass. The female bird glided

away from the nest on being approached, passing closely by me, and then fluttered along drooping her wings as if wounded, endeavoring thus to lead me away therefrom. It is very uncommon in any northern quarter through which we passed, although nests were subsequently discovered in the same as well as in other localities.

**242. *Tringa minutilla* Vieill. Least Sandpiper.**

This species was found breeding abundantly at Fort Anderson, on the borders of as well as in the Barren Grounds, and on and near the Arctic coast. Upwards of twenty nests were secured, and in all respects the latter were similar to those already described under this genus.

**246. *Breunetes pusillus* (Linn.). Semipalmated Sandpiper.**

Fairly abundant in the Barren Grounds, but more so on the shores of Franklin Bay, where a number of specimens with eggs were secured. The female when disturbed frequently glides from the nest, pretending to be disabled and thereby endeavors to draw away intruders. Occasionally the nests are hidden by tufts of grass. In reference to one of these, procured on 30th June, 1865, between two small brackish lakes near the seashore, it may be mentioned that one of our party, a French Canadian servant, once heard the female parent utter a shrill note of alarm as she flew away when he approached her nest. After searching about for a few minutes he failed to find the eggs, and he then hid himself in order to watch where she would alight on her return. In a short time she came back accompanied by three companions, all of which flew and moved about, but not discovering anything they seemed to hold a brief consultation, after which they separated, the female to her eggs. Another search failed to discover the nest, and the female returned again with the same birds, who appeared to be in a state of great excitement, judging from the chattering they kept up. After a little while they again separated, when the nest was found and the parent shot. The report of the gun brought the others once more to the spot, but they soon beat a hasty retreat. The nest was a mere depression in the midst of a tussock of hay, and lined with a few withered leaves and grasses.

**248. *Calidris arenaria* (Linn.). Sanderling.**

On 29th June, 1863, we discovered a nest of this species, "the only one at that time known to naturalists," on the Barren Grounds about 10 miles west of Franklin Bay. The nest was composed of withered hay and leaves placed in a small cavity or depression in the ground, and it contained four eggs, which were quite fresh. The female was snared. It is a very rare bird in that quarter, and we never afterwards succeeded in finding another nest. "The eggs measure 1.44 inches by 0.95 to 0.99 in breadth, and their ground color is a brownish olive,

marked with faint spots and small blotches of bi[s]tre. These markings are very generally diffused, but are a little more numerous about the larger ends. They are of an oblong-pyriform shape."

**251. *Limosa hæmastica* (Linn.). Hudsonian Godwit.**

Not very common, although several nests were taken near the post and on the Lower Anderson River. The nests were all mere depressions, or small holes scooped in the earth, thinly lined with decayed leaves, and in almost every instance they contained four eggs. "Three of the eggs received from the Anderson are in the Smithsonian collection. In two of these the ground is of a deep raw-umber color, or an olivaceous drab. There are no well-defined spots, but the apex of the larger end is deeply stained with a dark burnt-umber color. A few very indistinct spots of a paler shade of this tint are visible over the general surface of the eggs. The other egg has a ground color of a paler umber-drab, and the markings are quite distinct. These are small irregular blotches, longitudinal in their direction, and of a deep burnt-umber tint. The apex of the larger end is covered by a broad patch, in which all the markings of a very dark umber, almost black, run into each other. These eggs are pyriform in shape, and measure 2.15 by 1.41, 2.12 by 1.39, and 2.22 by 1.40 inches."

**255. *Totanus flavipes* (Gmel.). Yellow-legs.**

Probably the most abundant and certainly the noisiest of all the waders met with. Nests were found at Fort Anderson, on the Lower Anderson, in the wooded country to and along the rivers which flow through the Barren Grounds. In many instances the male bird was seen perching on trees in the vicinity, but when young were present both parents were particularly noisy, and did all that was possible to attract away intruders, while the former soon learned to run and screen themselves from view in the grass. Over thirty nest entries are recorded, while it is among the earliest of the waders which arrive and breed in the region under review.

**262. *Tryngites subruficollis* (Vieillot). Buff-breasted Sandpiper.**

This species is common in the Barren Grounds east of Horton River and on the Arctic coast. Between the 26th of June and the 9th of July upwards of twenty sets of eggs were secured, and there were four in every nest, which was a mere depression in the soil, scantily lined with a few withered leaves and dried grasses. When the nest was approached the female parent usually made a low flight to a short distance.

**263. *Actitis macularia* (Linn.). Spotted Sandpiper.**

Not being *desiderata*, comparatively few eggs were collected, although the bird itself is numerous along the Anderson and Lockhart Rivers, and in many other parts within the defined boundaries. It was not, however, observed by us on the shores of the Arctic Sea.

**265. *Numenius hudsonicus* Latham. Hudsonian Curlew.**

We did not encounter this curlew on our several eastern journeys to and from, nor on the coast of Franklin Bay; but it is by no means very rare in the "Barrens" to the west of the Lower Anderson, where the Esquimaux discovered some thirteen well identified nests with eggs.

**266. *Numenius borealis* (Forster). Esquimaux Curlew.**

This species breeds abundantly in the Barren Grounds to the eastward of Fort Anderson—and, except when otherwise described, these are the "Barrens," which are invariably referred to, right up to the Polar Sea. The nests in every observed instance were mere holes or depressions in the ground. Great difficulty was frequently experienced in finding them, as the eggs closely resembled the surrounding vegetation, and the mother, as a rule, glided off while we were still at some distance. Thirty sets of eggs were gathered, including several from the aforesaid Lower Anderson "Barrens." Among the many joyous bird notes which greet one while crossing these grounds, especially on a fine sunshiny morning, none seemed more familiar or pleasanter than the prolonged mellow whistle of the Esquimaux Curlew.

**270. *Charadrius squatarola* (Linn.). Black-bellied Plover.**

Our first introduction to this handsome and somewhat rare Arctic plover was on Island Point in Franklin Bay, on 4th July, 1864. The nest contained four eggs and was composed of a small quantity of withered grasses placed in a depression on the side or face of a very gentle eminence. Both parents were seen and the male shot. We at first mistook them for the Golden Plover, which they so much resemble, but their note and a close comparison of skins soon undeceived us. On the following day another nest with four eggs was discovered, and a third also was met with, over which a snare was set; but, unfortunately, while we slept, a Snowy Owl (*Nyctea nyctea* Linn.) devoured the captured female, together with her four eggs. In 1865, seven nests were gathered by our party in the same quarter. It is probable that both parents relieve each other during the process of incubation, as a male bird was snared on one of the nests. We never received a single skin or egg of this, but plenty of the Golden Plover, from the Esquimaux of the Lower Anderson or from the shores of Liverpool Bay.

**272. *Charadrius dominicus* Müll. American Golden Plover.**

This beautiful species is very numerous in the Barren Grounds, from the outskirts of the forest to the shores of the Polar Sea. The nests were precisely similar to those of *C. squatarola*. They were also as difficult to detect, and for the same reason, a harmonizing resemblance of the egg markings to the surrounding soil and a timeous departure of the female bird from her nest. In a very few instances, where she happened to be surprised by a close approach, she would pretend lameness and

flutter away from our very feet. On one occasion our party spent half an hour in a close but fruitless search, during which the female resorted to various maneuvers to hide the nest; but on our withdrawal to a short distance she at last revealed it by settling down upon her eggs. I find one hundred and seventy nests recorded among my notes. Except when there was reason to believe that the full number had not been deposited four eggs were always met with. In one instance, however, there was as many as five, and in another but one, the contents of which were found in a well-developed condition. Foxes also destroy many eggs and young of this and other species during the season of nidification. The frequently varying but sweetly clear and melodious notes of this Plover are almost constantly heard whilst traversing their usual breeding grounds.

274. *Agialitis semipalmata* Bonaparte. Semipalmated Plover.

This bird is quite common on the before defined coast of the Arctic Ocean and along the Anderson and Lockhart Rivers, as well as in the country between Fort Anderson and Fort Good Hope, Mackenzie River. Most of the twenty nests taken contained four eggs, and several but two or three. When closely approached, the female usually glided from her nest and ran a short distance before flying, occasionally drooping her wings and pretending lameness. The nest is a mere cavity in the sand lined with a few withered leaves and grasses.

283. *Arenaria interpres* (Linn.). Turnstone.

In June, 1864, a dozen birds were observed at Fort Anderson, and one was shot. This species breeds on the shores of Liverpool and Franklin Bays, and on the Lower Anderson River. Several nests were secured in the latter region; but none were met with in the Barren Grounds. Four was the maximum number of eggs in a nest, which was similar to that of other waders.

## LAND BIRDS.

298. *Dendragapus canadensis* (Linn.). Canada Grouse.

Although no nest was discovered, this grouse has been frequently observed in the forest country south of Fort Anderson.

301. *Lagopus lagopus* (Linn.). Willow Ptarmigan.

This species is exceedingly abundant in the neighborhood of Fort Anderson on the Lower Anderson River, and in the wooded country to the eastward. It is not, however, common in the Barren Grounds, especially from Horton River to Franklin Bay, where it is replaced by *L. rupestris*. The nest is invariably on the ground, and consists of a few withered leaves placed in a shallow cavity or depression. The

female sometimes only leaves it when almost trodden under foot—in fact, several were swooped upon and caught thereon by hand! They usually begin to lay about the end of May or beginning of June. The process of moulting or the gradual assumption of their summer plumage commences a week or two earlier. The female lays from seven to ten, twelve and occasionally as many as thirteen eggs, which I find was the greatest number recorded, and we had reason to know that some at least of the nests were used by Ptarmigan several seasons in succession. When very closely approached, as stated, the female would frequently flutter off, sometimes spreading her wings and ruffling her feathers as if to attack or frighten away intruders; and at others, calling out in distressed tones and acting as if she had been severely wounded. In one instance, where an Indian collector had found a nest which then contained seven eggs, he placed a snare thereon; but on returning to the spot a few hours afterwards, he was surprised to find that six of the eggs had disappeared in the interim, and, as no egg shells (the male escaped) were left behind, they were, in all probability, removed by the parents to a safer position. The male bird is generally not far away from the nest; and his peculiarly hoarse and prolonged note is very frequently heard, the more especially between the hours of 10 p. m. and 2 a. m. Both, however, displayed great courage and devotion in protecting their young, which we often encountered on our return coast trips, from capture. In course of the five exploring seasons, nearly five hundred nests and considerably over three thousand eggs of this species were secured in the Anderson region. In the end of September, during October, and early in November, annually, *L. lagopus* assemble in large flocks; but during the winter it was seldom that more than two or three dozen were ever noticed in single companies. They are, however, most winters very numerous in the neighborhood of Fort Good Hope and other Hudson Bay Company's posts in the Mackenzie River district; but as the spring sets in they begin to migrate northwards. It is very doubtful if many breed to the south of latitude 68° north—at least, in the valley of the Anderson.

302. *Lagopus rupestris* (Gmel.). Rock Ptarmigan.

This ptarmigan is not near so plentiful as *L. lagopus*, and we only met with it in any considerable numbers from Horton River, Barren Grounds, to the shores of Franklin Bay. Very few nests were found to the eastward of that river, or on the coast or "Barrens" of the Lower Anderson. Its nest is similar, but it lays fewer eggs than *L. lagopus*, as nine proved to be the rarely attained maximum among an aggregate record of sixty-five nests—the usual number was six and seven, and there were some which held only four and five eggs. Several of these would doubtless have contained more had they been discovered at a later date. It was no easy matter, however, to find the nests of this species, as the plumage of the birds and the color of the eggs both



strongly resembled the neighboring vegetation. At the same time the female sat so very closely that more than one was caught on the nest; and I recollect an instance where the female bird, on the very near approach of our party, must have crouched as much as possible, in the hope that she might not be noticed, which would have happened had not one of the smartest of our Indian collectors caught a glance of her eye. Although lots of male "Rockers" were observed on our summer trips, feeding and otherwise disporting themselves in the "Barrens," yet comparatively few nests were obtained, and except in 1862 not one well identified example was discovered west of Horton River, but during winter scores of *L. rupestris* were met with in the forest country east of Fort Anderson.

308. *Pediocætes phasianellus* (Linn.). Sharp-tailed Grouse.

This grouse breeds in the pine forests on both sides of the Lockhart and Upper Anderson Rivers, where one or two nests were met with, but the eggs were afterwards lost.

331. *Circus hudsonius* (Linn.). Marsh Hawk.

In June, 1865, an Esquimau snared a female bird on her nest on a willow bush along the Lower Anderson River. It contained five eggs. In June, 1866, a nest composed of twigs and grasses, etc., was found in a similar position; there were six eggs, but they were unfortunately among those lost that season.

334. *Accipiter atricapillus* (Wilson). American Goshawk.

This species is confidently believed to breed, in small numbers however, in the wooded country between Fort Good Hope and the Anderson.

342. *Buteo swainsoni* Bonap. Swainson's Hawk.

In July, 1861, we discovered a nest of this species which was built on a spruce tree along Onion River, the principal tributary of the Lockhart. It contained two well-grown birds. Both parents were about and made a great ado in endeavoring to protect their offspring. The male was shot. In June, 1865, another nest was found on the top crotch of a tall pine in a ravine some 20 miles southeast of Fort Anderson. In composition it was similar to the nest of an *Archibuteo*. The female was shot as she got off her nest, which contained but one egg in a well developed stage. The male was not seen.

347a. *Archibuteo lagopus sancti-johannis* (Gmel.). American Rough-legged Hawk.

This form of *A. lagopus* is abundant in the Anderson district, as specimens have been obtained from all parts of the surrounding forest to the borders of the Barrens, as well as from the Arctic coast. I

find that no less than seventy nests were collected during the period of exploration treated of by my notes. About fifty-five of them were built in the crotches of trees not far from the top, and at a height of 20 or 30 feet from the ground. They were composed externally of sticks, twigs, and small branches, rather comfortably lined with hay, mosses, down, and feathers. The remaining fifteen were situated near the edge of steep cliffs of shady rock on the face of deep ravines and on declivitous river banks, and they were usually made of willow sticks and twigs, but with a thicker lining of hay, moss, and other soft materials. The eggs varied from three to five, never more than the latter number, and their contents were like those of some other birds' eggs gathered by us, in different stages of incubation in the same nest. The parents invariably manifested great uneasiness and frequently gave utterance to vociferous screams of anger and distress when their nests were approached. Early in June, 1864, one of our Indian employés found a nest containing three eggs on a high ledge of bituminous shale, and, as the rule was to secure the parent bird in all possible cases for identification, having missed killing both he placed a snare about the nest, but on going to it later in the day he was disgusted at finding the snare set aside, the eggs gone, and the birds not to be seen; but as there were no shell remains he presumed that they had removed the eggs to a safer position, which he, however, failed to discover. "Dozens," and not as stated "hundreds," of skins of this species were forwarded by us to the Smithsonian Institution.

349. *Aquila chrysaëtos* (Linn.). Golden Eagle.

From various points along the valley of the Anderson River to its outlet in Liverpool Bay and from the mouth of the Wilmot Horton in Franklin Bay, an aggregate of twelve nests of this eagle were obtained by us in the course of the seasons from 1862 to 1865, inclusive. Ten of this number were built against the face of steep and almost inaccessible banks of shale or earth at a height sometimes of 70 or 80 feet, and from 20 to 30 feet below the summit. One thus examined, in 1864, was found to be of considerable size, and it was composed of a large platform of built-up twigs and sticks, having a bed of hay, moss, and feathers in the center, and, as this and other similarly constructed nests appeared to be annually renovated prior to reoccupation, they must ultimately assume vast proportions. Pillaged nests are however frequently deserted for a period, but in one instance where the female had been snared upon her nest and the eggs taken it was found occupied the following season probably by the widowed male with another mate. She was shot and proved to be a mature bird. In two instances only were the nests constructed near the top of tall spruce pines; the sandy nature of the soil in their vicinity was not favorable for building on cliffs. But in no case, however, did any of our party find or our collectors report having seen a large accumulation of bones or other food débris on or in the

neighborhood of the nests. All of these but one contained two eggs, while the oviduct of that particular female contained the other. In confinement, even when taken young, they are fierce and perhaps untamable, though they readily eat the food given to them, whether it be fish or meat. One of four, thus reared at Fort Anderson a year or two later, ferociously killed two of her partners. They kept their plumage in a very cleanly condition, and they always grasped their food in the talons of either leg and tore it with their beaks. After feeding they invariably removed any blood or other impurities which might have adhered to the beak by scratching it with their talons or rubbing it against the bars of their cage. The eagles in question were kept in a cage in the dwelling house during the colder months of the winter, but in April we had them removed to a larger one outside, where they exercised themselves by jumping off and on their roosting poles, and they also seemed much interested in all that they observed taking place within the Fort Square. It is, however, remarkable in this connection that the parent birds may be said to have never given any trouble while their nests were being robbed. Mice, lemmings, and marmots form no unimportant item in the diet of this eagle, one of which was once seen hunting Parry's *Spermophile* or Marmot, near Langton Harbor, Franklin Bay.

**352. *Haliaeetus leucocephalus* (Linn.). Bald Eagle.**

Several nests were found with eggs and young in them on Lockhart and Anderson Rivers. They were built on high trees close to the river banks and composed of dried sticks and branches lined with deer hair, mosses, hay, and other soft materials. There were from two to three eggs in each nest. In one instance the parents made hostile demonstrations when their nest was being robbed, but they generally flew away and kept at a safe distance. They are not very numerous, and it is doubtful if any breed to the northward of Fort Anderson.

**354a. *Falco rusticolus gyrfalco* (Linn.). Gyrfalcon.**

This gyrfalcon is common in the wooded country on both sides of Anderson River. Over twenty nests were secured, and with only two exceptions, which were built, one on a ledge of rocks and the other against the side of a deep ravine, they were found close to or near the top of the tallest trees in the neighborhood. They were similar in composition, but smaller in size than those of the Bald Eagle; and while the number of eggs was either three or four, their contents were frequently found in differing stages of development. Both parents invariably manifested much anger and excitement when interfered with or even distantly approached. They made a great noise, and, indeed, oftener than once their folly in coming to scream loudly over our heads attracted attention to some that would otherwise have escaped notice. The earliest date of finding a nest was May 10. The eggs were quite

fresh, though one taken five days later contained partially formed embryo. In a few cases young birds were in the same nest along with eggs, the contents of which were but little changed, and in another an egg perfectly fresh was found with several ready to hatch. This Falcon is supposed to be a "winterer" in the northern territories of Canada, where its prey is said to consist chiefly of partridges. The allied *F. rusticolus* (Linn.), or probably *F. islandus* (Brünn.), breed in small numbers in the same region, as the Indians often spoke of a large hawk, twice observed by myself, which had successfully eluded all attempts to capture itself or its eggs.

356. *Falco peregrinus anatum* (Bonap.). Duck Hawk.

This falcon constructs no nest whatever so far as I know. It lays its eggs on the most inaccessible ledge of a river cliff of strata, earth, or rock. Four is the usual number, and in some instances the eggs were larger than in others. All of the discovered nests were found in the country to the southward of the post, and it is doubtful if they breed much beyond latitude 68° north. The Duck Hawk makes a great ado when its eggs are taken. Early in August, for several successive years, young birds of the season, fully fledged, but still attended by their parents, were noticed along the limestone and sandstone banks of the Mackenzie River.

357. *Falco columbarius* Linn. Pigeon Hawk.

This falcon ranges along the Anderson River almost to the Arctic coast of Liverpool Bay. Several of their nests had apparently been built by them on pine trees, and others on the ledges of shaly cliffs. The former were composed externally of a few dry willow twigs and internally of withered hay or grasses, etc., and the latter had only a very few decayed leaves under the eggs. In one instance the oviduct of the female contained an egg almost ready for extrusion. It was colored like the others, but the matter was still so soft that it adhered to the fingers on being touched. This peculiarity was noticed in the case of several among a number of similarly discovered eggs, although a few examples taken from the oviduct of the same species were perfectly white. I would also mention the following interesting circumstance: On the 25th of May, 1864, a trusty Indian in my employ found a nest placed in the midst of a thick pine branch of a tree at a height of about six feet from the ground. It was rather loosely constructed of a few dry sticks and a small quantity of coarse hay. It then contained two eggs. Both parents were seen, fired at, and missed. On the 31st he revisited the nest, which still held but two eggs, and again missed the birds. Several days later he made another visit thereto, and to his surprise the eggs and parents had disappeared. His first impression was that some other person had taken them. After looking carefully around, he perceived both birds at a short distance, and this

led him to institute a search which soon resulted in finding that the eggs must have been removed by the parent birds to the face of a muddy bank at least forty yards distant from the original nest. A few decayed leaves had been placed under them, but nothing else in the way of lining. A third egg had been added in the interim. There can hardly be any doubt of the truth of the foregoing facts.

358. *Falco richardsonii* Ridgway. Richardson's Merlin.

This species is supposed to breed in the same region as *F. columbarius*, and in all probability some of the eggs appearing thereunder may have belonged to Richardson's Pigeon Hawk.

364. *Pandion haliaetus carolinensis* (Gmel.). American Osprey.

If this species does not extend quite to Fort Anderson, I feel satisfied that I have seen more than one specimen, though not sufficiently near to be shot, between that post and Fort Good Hope on Mackenzie River.

367. *Asio accipitrinus* (Pallas). Short-eared Owl.

Twelve nests of this species were found in various situations in the "Barrens," as well as in wooded tracts, but all were on the ground and mere depressions apparently scraped for the purpose, and lined with dried grasses and withered leaves; a few feathers were noticed in about half of them, and they seemed to have been plucked from her breast by the parent bird. She occasionally sits very close on her nest. The number of eggs in a nest varied between three and five, and but one contained as many as seven. On 30th June, 1865, an Owl was observed flying about a particular spot in the Barren Grounds, and we concluded that its mate was not far off, a suspicion confirmed by its uneasy excitement as soon as a search was instituted. Myself and four of our party were thus fully engaged over an hour ere success rewarded our efforts by the female getting off her nest in the center of a small clump of dwarf willows, one foot in height, just as she was almost trodden upon. It was composed of withered grasses and feathers, and contained five eggs. We must have frequently approached her in the course of our protracted search.

370. *Scotiopteryx cinerea* (Gmel.). Great Gray Owl.

I should not say that this owl was in "great abundance" in the Anderson region, as inadvertently stated on page 33, vol. III, of the Land Birds. We certainly observed very few specimens, and we found but one nest, that referred to in the same paragraph, on the 19th July, 1862, near Lockhart River, on the route to Fort Good Hope. It was built on a pine spruce tree at a height of about twenty feet, and was composed of twigs and mosses thinly lined with feathers and down. It contained

two eggs and two young, both of which had lately died. The female left the nest at our approach and flew to another tree at some distance, where she was shot.

**371. *Nyctala tengmalmi richardsoni* (Bonap.). Richardson's Owl.**

This owl, or a bird closely answering to the description, was repeatedly observed in the country between Fort Good Hope and the Anderson River.

**375b. *Bubo virginianus arcticus* (Swainson). Arctic Horned Owl.**

A similar remark to that made regarding No. 371 will also prove correct under this owl, or to the *B. virginianus subarcticus* of Hoy.

**376. *Nyctea nyctea* (Linn.). Snowy Owl.**

This species is not plentiful in the Anderson country, while every effort made to secure even one specimen nest with its eggs proved unsuccessful. On one occasion we noticed a white owl hunting marmots (*Spermophilus empetra*) in the barren grounds; and there can be no doubt that this and other owls sometimes rob ptarmigan and ducks, etc., of their eggs.

**377a. *Surnia ulula caparoch* (Müll.). American Hawk Owl.**

The Hawk Owl is not uncommon in the region of Anderson River, although only four nests were discovered and the eggs taken therefrom. All of these were built in pine trees at a considerable height from the ground. One was actually placed on the topmost boughs, and, like the others, it was constructed of small sticks and twigs lined with hay and moss. The male and female of the latter were shot, and the nest contained two young birds, one of which was apparently ten days and the other three weeks old, together with an addled egg. All of the others, however, but one, had six eggs, and in a single instance as many as seven were secured. The parents always disapproved of our proceedings. Very few owls were observed on the lines of march traveled over during the seasons of 1864 and 1865. This species winters in Arctic America.

**390. *Ceryle alcyon* (Linn). Belted Kingfisher.**

Although several birds were seen on the Anderson and elsewhere, and some skins were obtained from the Esquimaux, yet we never found any nests, nor received its eggs from any of the natives.

**400. *Picoides arcticus* (Swainson). Arctic Three-toed Woodpecker.**

It is believed that this species breeds and also winters in the Arctic regions. My notes record the finding at Fort Anderson, on 30th May, 1863, of a nest containing three perfectly fresh eggs—a mere hole in a

dry pine several feet from the ground. A female bird answering to the given description was shot in its vicinity. It may, however, have been an example of *P. americanus*.

**401a. *Picoides americanus alascensis* (Nelson). Alaskan Three-toed Woodpecker.**

Although no reference is made to their receipt in the said Land Bird's History, my notes record that on 5th June, 1864, both parents were shot in close proximity to the nest, which contained four eggs. It was a hole in a dry spruce, at a height of six or seven feet—the eggs were lying on the decayed dust of the tree and their contents were perfectly fresh. On 21st June, 1864, a nest probably of the same species was found in a similar position, and it was occupied by four young birds of a week or ten days age. One of the parents was seen in the vicinity. This bird was formerly known, and the specimens receipted by the Smithsonian, as *P. hirsutus*.

**412. *Colaptes auratus* (Linn.). Flicker.**

It is by no means scarce in the valley of the Anderson; but as its eggs are not in demand very few indeed were gathered for transmission to Washington.

**420. *Chordeiles virginianus* (Gmel.). Nighthawk.**

A few straggling birds have been observed in the far north; but I never came across its nest except in the Clear Water River, Athabasca, where one containing two eggs was found on the ground in the end of June, 1873.

**468. *Empidonax hammondi* (Xantus). Hammond's Flycatcher.**

From an article published in Volume II of the "Proceedings of the United States National Museum, 1879," by the late eminent and well-known oölogist, Dr. Brewer, of Boston, I find a reference to some eggs of this Flycatcher obtained from "Anderson River," which I conclude were sent to the Smithsonian among a number of unidentified specimens, as I can discover no specific record thereof, nor of an example of *Myiodiotes pusillus*, entered in the Receipt List of Birds, under either heading, in my field notes.

**474. *Otocoris alpestris* (Linn.). Horned Lark.**

Nine nests of this lark were received at Fort Anderson—a few of them from the Esquimaux, and the others were collected by us in the Barrens and on the coast of Franklin Bay. The nest was usually composed of fine hay neatly disposed and lined with deer hair. Several of the parent birds were secured by snares placed thereon.

484. *Perisoreus canadensis* (Linn.). Canada Jay.

Tolerably numerous in the wooded country, even to its northern and eastern limits; but none were observed by us in the Barrens proper west or east of Horton River, nor on the Arctic coast. While snow is still on the ground it usually builds its nest in spruce or tamarac trees—often in the middle of a swamp—on the branches close to the trunk and well concealed from view, and at a height of about nine or ten feet. They are constructed of hay and feathers, supported underneath by twigs and willow sticks laid crosswise and partly interlaced. On 11th May, 1863, an Indian discovered a nest and one egg perfectly fresh, along with two young birds a few days old. Another nest contained four eggs, the contents of which were in a more or less developed stage of incubation. It is very probable that the one referred to, as well as all other specimens of the "Whisky Jack" procured from the lower Anderson and Mackenzie Rivers, may really belong to Ridgway's recently determined form of this Jay, *P. canadensis fumifrons*.

486. *Corvus corax principalis* Ridgway. Northern Raven.

This species is abundant at Fort Anderson and on the lower Lockhart and Anderson Rivers; and although not seen by us there, it may possibly breed on the shores of the Arctic Sea. All but one of the eight recorded nests were situated on tall pines, and composed of dry willow sticks and twigs and thickly lined with either deer hair or dry mosses, grasses, and more or less hair from various animals. The average number of eggs was six, but instances of seven and eight were common. In the months of February and March, 1865, a raven became almost domesticated at Fort Anderson. At first it fed on garbage outside of the fort with a companion; but shortly after it came alone, alighting within the stockade square, and would allow itself to be very closely approached by the inmates. Several young dogs soon became familiar therewith, and they would even frolic and gambol together. It was never known to attempt to injure the smallest of them, nor did they ever offer to annoy it. While this raven seemed to have full confidence in the people of the fort it kept at a careful distance from all Indian or Esquimaux visitors. It, however, suddenly disappeared one day, having probably come to grief. On 11th June, 1863, an Esquimaux brought me an egg of a Pigeon hawk and the head of a crow, having, as he declared, shot it on the nest, which was built on the topmost crotch of a pine tree—the latter therefore probably either ate the other eggs, shells and all, if there were any, or dispossessed the former birds with the view of occupying it herself.

488. *Corvus americanus* Audubon. American Crow.

On 10th May, 1865, an Esquimaux snared the parent bird on a nest which was built on the top of a tall spruce on the Lower Anderson River—a mass of dried twigs and branches lined with hay, mosses, and



sundries—it contained four eggs. Another, taken near the fort on 5th May, 1866, had five eggs with largely developed embryos in them.

**509. *Scolecophagus carolinus* (Mill.). Rusty Blackbird.**

This bird is fairly abundant in the neighborhood of Fort Anderson; but examples were frequently observed as far as the eastern limits of the forest, as well as near the "crossing" on Horton River, in about latitude 69° N. and longitude 125° W. The twenty-five nests discovered in these several localities were built on trees at a height of from 5 to 8 feet from the ground. Five eggs was the maximum number found in any one nest. The parents manifested great uneasiness when their nests were approached, and they would often fly from tree to tree in order to attract one away from the spot.

**515. *Pinicola enucleator* (Linn.). Pine Grosbeak.**

In the spring of 1861 an Indian discovered a nest of this species on a pine tree some 60 miles south of Fort Anderson, but unfortunately while descending therewith he fell and destroyed both nest and eggs; and although we frequently observed some birds at the post and elsewhere, we never succeeded in finding another nest.

**521. *Loxia curvirostra minor* (Brehm). American Crossbill.**

Several birds resembling the published description of this species were seen at Fort Anderson, fired at and missed on 20th June, 1862, but the closest search failed to discover any nests.

**522. *Loxia leucoptera* Gmel. White-winged Crossbill.**

A male and female specimen of this crossbill was obtained during our residence on the Anderson, where examples—some of which were subsequently lost—of *special desiderata* were kept in hand for the benefit of our Indian and Esquimaux collectors. The former assured me that they had occasionally observed birds of both, but especially this species, in the country to the southward of the fort.

**527a. *Acanthis hornemannii exilipes* (Coues). Hoary Redpoll.**

Common on Anderson River. They build their nests on low pine and willow bushes, and the eggs are usually four and five in number. This is believed to be one of the "winterers" in that quarter. *A. hornemannii* may also be a residenter.

**528. *Acanthis linaria* (Linn.). Redpoll.**

A similar remark will apply here as under the preceding, both species being about equally abundant in the wooded country. In all we received and exported about eighty nests belonging to Nos. 527a and 528, and we found them more abundant in 1864 than during any other season.

534. *Plectrophenax nivalis* (Linn.). Snowflake.

The only authenticated nest and eggs (No. 10433) in the Smithsonian Museum in 1874 was that discovered by us on 8th July, 1864, in a small hole large enough to admit of the female, and it was placed at a distance of nearly 2 feet from the entrance, in a sand bank along the shores of Franklin Bay. "The nest is deeply saucer-shaped, and composed of wiry grass stems, with a few feathers in the lining. External diameter 3.75 inches, internal about 3, depth 2.50 externally and 1.50 internally. The eggs, five in number, are of a dull white, with perhaps a faint bluish cast, sprinkled and spattered with a dilute yellowish rufous, the markings most numerous towards the larger end. They measure 0.95 of an inch in length, by 0.64 in breadth." The parent bird was snared on the nest. In 1865 we observed a number of *P. nivalis* on the same coast, but failed to find another nest.

536. *Calcarius lapponicus* (Linn.). Lapland Longspur.

Altogether eighty-three nests of this species were obtained in the Barren Grounds, as well as on the shores of Franklin Bay. One from the latter, found on 27th June, 1864, was like all the others, built on the ground, "and is deeply saucer-shaped, measuring 3.75 inches external and 2.30 inches internal diameter; the depth 2.75 exteriorly and 1.50 interiorly. It is composed of coarse wiry grass stems and softly lined with feathers of *Lagopus*. The eggs, five in number, have the ground color light umber-drab, faintly blotched with deeper livid slate, and with a few straggling black lines, much as in certain *Icteridæ* and in *Chondestes*. They measured 0.86 of an inch in length by 0.63 in breadth.'

537. *Calcarius pictus* (Swains.). Smith's Longspur.

Very abundant in the country to the eastward of Fort Anderson, in the Barren Grounds and on the Lower Anderson River. These several localities yielded an aggregate of one hundred and fifty nests. They were all on the ground, and usually in open spaces or plains, but some were also placed in the vicinity of trees. The average number of eggs was four; occasionally as many as five. "The nests were constructed of fine dry grasses, carefully arranged and lined with down, feathers or finer materials similar to those of the outer portions. In a few there were no feathers, in others feathers in varying proportions, and in several the down and feathers composed the chief portion of the nest, with only a few leaves and a little hay as a base for the nest."

540. *Pooecetes gramineus* (Gmel.). Vesper Sparrow.

On 26th June, 1864, we found a nest of this species containing six eggs, in a sparsely wooded tract of country east of Fort Anderson. The female was snared. The bird, as well as the nest and eggs, all strongly

agreed with the published description, but, as it is stated in the history referred to that no specimens were obtained by us, I must conclude that they were lost en route or that we had erred in our identification.

**542a. *Ammodramus sandwichensis savanna* (Wilson). Savanna Sparrow.**

Numerous on the Anderson, and, although frequenting marshes, it generally makes its nest on dry ground, of course, with a lining of the finer grasses. There are usually from four to six eggs in a nest.

**542b. *Ammodramus sandwichensis alaudinus* (Bonap.). Western Savanna Sparrow.**

Very abundant in marshy and sparsely wooded tracts or plains near Fort Anderson and on the lower river, seeing that "upwards of two hundred nests with eggs" were collected in that quarter. They were all placed on the ground and composed of dry stems of grasses, lined with finer materials of the same. Sometimes the nests are lined with a few feathers and deer's hair. The number of eggs in a nest was four or five.

**556. *Zonotrichia leucophrys intermedia*, Ridgway. Intermediate Sparrow.**

Later investigations have resulted in determining that all references to *Z. gambeli* (Nutt) given in Baird, Brewer and Ridgway's History of North American Birds should apply to this new species, which replaces the other in northern Alaska, as well as on the Lower Anderson and Mackenzie Rivers. The Intermediate Sparrow breeds in great numbers in the wooded sections of Anderson district. The nests were nearly always placed on the ground, in the tufts or tussocks of grass, clumps of Labrador tea (*Ledum palustre*), and amid stunted willows. They were composed of fine hay and lined with deer hair, occasionally mixed with a few feathers. Several were made entirely of the finer grasses. The usual number of eggs was four, but a lot contained as many as five and six. Upwards of one hundred nests were collected in the region referred to.

**559. *Spizella monticola* (Gmel.). Tree Sparrow.**

This is perhaps the most abundant Sparrow found breeding in the valley of Anderson River, as is evidenced by the number of nests, two hundred and sixteen, secured. They were almost invariably composed of hay or dried grasses, intermixed with a little stringy bark and lined with feathers. Most of them were found on the ground and the others on dwarf willow, at a height of from one to four feet. Four and five eggs, occasionally as many as six and seven, appeared to be the complement. It is possible that the Alaskan form *S. monticola ochracea*, Brewster, may also nest in this quarter.

567. *Junco hyemalis* (Linn.). Slate-colored Junco.

This species breeds in the forest and to the border of the Barrens, where several birds, nests, and eggs were secured. These were always on the ground and made of fine hay lined with deer hair. Four and five eggs were the usual numbers found in them.

585. *Passerella iliaca* (Merrem). Fox Sparrow.

Tolerably common on both banks of the Anderson, and two or three nests were also discovered in the vicinity of a small stream named Swan River, in the Barren Grounds. Most of the nests were built on trees, and they resembled those of *Turdus alicia*, but a few found on the ground, however, were composed of coarse dry grass, lined with some of a finer quality, a few deer hairs, and a sprinkling of fresh moss. The complement of eggs varies from four to five.

612. *Petrochelidon lunifrons* (Say). Cliff Swallow.

In 1856, about one hundred and sixty nests of these Swallows were, for the first time, built under the eaves of the three principal buildings of Fort Good Hope, Mackenzie River, but, as many of the young were destroyed by Indian boys, only one hundred nests were constructed at the same place the following season. In 1866 a bird of this species was observed closely examining the eaves of the houses at Fort Anderson, but, probably not finding them suitable or in consequence of having been rudely disturbed by an Indian boy throwing stones thereat, it flew away and never returned. They however breed in large numbers along the banks of the Lockhart and Anderson Rivers, whence several examples were obtained.

616. *Clivicola riparia* (Linn.). Bank Swallow.

This species is to be met with in considerable numbers during the season of nidification. It builds its nests in holes in sandy clayey banks on Anderson River. Several birds and eggs were taken, but, not being in much request, their collection was discouraged.

618. *Ampelis garrulus* Linn. Bohemian Waxwing.

Up to 1874 "the only instances on record of the discovery of the eggs of this interesting bird in America were those of a nest and one egg taken, by the late Mr. Kennicott, at Fort Youkon, Alaska, in 1861, and of a nest and egg found the same season in a pine tree on Anderson River, in about latitude 68° north. Both are now in the Smithsonian Institution at Washington." Several skins of the bird were obtained at Fort Anderson in 1862, but the most diligent search failed to secure any more nests or eggs.

621. *Lanius borealis* Vieill. Northern Shrike.

A nest of the Northern Shrike, containing six eggs, was obtained at Fort Anderson on 11th June, 1863. "This is in many respects in striking contrast with the nests of its kindred species of the Southern States, far exceeding them in its relative size, in elaborate finish, and warmth. It is altogether a remarkable example of what is known as felted nests, whose various materials are most elaborately matted together into a homogeneous and symmetrical whole. It is seven inches in diameter and three and a half in height. The cavity is proportionately large and deep, having a diameter of four and a half inches and a depth of two. Except the base, which is composed of a few twigs and stalks of coarse plants, the nest is made entirely of soft and warm materials, most elaborately interworked together. These materials are feathers from various birds, fine down of the Eider and other ducks, fine mosses and lichens, slender stems, grasses, etc., and are skillfully and artistically wrought into a beautiful and symmetrical nest, strengthened by the interposition of a few slender twigs and stems without affecting the general felt-like character of the whole. The eggs measure 1.10 inches by .80, and are of a light-greenish ground, marbled and streaked with blotches of obscure purple, clay color and rufous brown." A second nest of a less elaborate character, containing eight eggs, was subsequently discovered on Anderson River, to the northward of the post.

646. *Helminthophila celata* (Say). Orange-crowned Warbler.

This is one of the rarest Warblers which breed on the Anderson, where several of its nests, containing from four to six eggs, were found. They were made of hay or grasses, lined with deer hair, feathers and finer grasses, and placed on the ground in the shade of a clump of dwarf willow or Labrador tea.

652. *Dendroica aestiva* (Gmel.). Yellow Warbler.

Very abundant throughout the entire wooded region of Arctic America, where it builds on dwarf willows and small scrub pine, at a height of a few feet from the ground. As their eggs were not wanted, we did all that was possible to discourage their collection.

655. *Dendroica coronata* (Linn.). Myrtle Warbler.

This Warbler is not numerous on the Anderson, where some thirteen nests were found, built on low spruce trees, and a few were also placed on the ground. It lays from four to five eggs.

661. *Dendroica striata* (Forster). Black Poll Warbler.

More plentiful than *D. coronata*, although only twenty-one nests were secured. They were similarly situated, and contained four or five eggs, and two or three of them were found on the ground.

697. *Anthus pensilvanicus* (Latham). American Pipit.

There is reason to believe that this bird is also among those that resort to Anderson River during their annual season of reproduction.

739. *Parus cinctus obtectus* (Cabanis). Siberian Chickadee.

On 1st June, 1864, a nest of this species, containing seven eggs, was found near Fort Anderson, in a hole in a dry spruce stump, at a height of about 6 feet from the ground. It was composed of a moderate quantity of hare or rabbit fur, intermixed with a sprinkling of dried moss. The female parent was snared on the nest, but the male was not seen. The contents of the eggs were tolerably fresh. It has since turned out that "this was the first specimen of the Siberian Chickadee obtained on the American Continent." As birds of the genus undoubtedly winter in that region, additional examples of this, and some also of *P. atricapillus septentrionalis* (Harris) and *P. hudsonicus*, Forster may be discovered there some day.

749. *Regulus calendula* (Linn.). Ruby-crowned Kinglet.

There can be no doubt that this kinglet is to be met with during the summer season on the Anderson River, as both Indians and Esquimaux assured me that they had seen birds exactly similar to a Good Hope specimen shown to them.

757. *Turdus aliciae* Baird. Gray-cheeked Thrush.

This thrush is very abundant in the Anderson River region, not only wherever trees are to be had for nesting purposes, but also in situations where none exist. "More than 200 specimens (mostly with their eggs) having been sent from Fort Anderson to the Smithsonian Institution." The greatest number were built on trees in the usual manner, but some few of them were placed on the ground. One nest was also taken on the banks of the Wilmot-Horton River.

761. *Merula migratoria* (Linn.). American Robin.

One of the most numerous and widely distributed of American birds, but not being *desiderata*, scarcely any of its eggs were received at Fort Anderson, where, on the contrary, both Indians and Esquimaux were enjoined not to interfere with its nests. A few were also met with on the banks of the Swan and Wilmot-Horton Rivers, in the Barren Grounds. Comparatively few parents display greater courage and devotion in the defense of their young than Robin Red-breast.

NOTE.—In the preparation of the foregoing list and relative notes at this remote point in British Columbia I have labored under the disadvantage of having but a rather limited number of necessary books to refer to, and may, therefore, have unwittingly fallen into a few errors which a fuller access would have obviated. I may further add that during the period of which they treat a few examples of fish, insects,

plants, and shells were gathered for the Smithsonian Institution, besides a considerable collection of ethnological specimens pertaining to the Esquimaux of the Anderson and Mackenzie Rivers, while a list of the mammals obtained and observed by me in the northern regions of the Dominion may possibly form the subject of a similar but shorter paper in the near future.

R. MACFARLANE.

FORT ST. JAMES, STUART'S LAKE,  
NEW CALEDONIA DISTRICT,  
*British Columbia, June 25, 1889.*

ADDITIONAL NOTE.—Early in July, 1889, the manuscript of the aforesaid notes was transmitted to President Bell, but several months passed before it was read by him at a meeting of the Historical and Scientific Society of Manitoba, Winnipeg. Two or three more months elapsed ere the paper itself was published as Transaction No. 39, Season 1888-'89. The sample copy thereof received by me at this place contained so many printer's errors, besides some introduced nomenclature, that I asked Mr. Bell to have it reprinted; but as this was impossible, I have decided on publishing an edition of the notes in question, which I hope will prove more acceptable to naturalists, as the referred-to blemishes have been removed, while I have also made a few corrections and additions kindly pointed out by a friend (Capt. Charles E. Bendire, U. S. Army), in Washington, who, from his long and important connection with the Smithsonian Institution and the U. S. National Museum, had become well acquainted with the variety and extent of the Fort Anderson collections.

R. MACFARLANE.

CUMBERLAND HOUSE, CUMBERLAND DISTRICT,  
*Saskatchewan, N. W. T., November 25, 1890.*

# ON THE CHARACTERS OF SOME PALEOZOIC FISHES.

BY

E. D. COPE.

(With Plates XXVIII—XXVIII.)

## I.—ON A NEW ELASMOBRANCH FROM THE PERMIAN.

*Styptobasis knightiana* Cope. Gen. et sp. nov. Fig. 1.

**CHAR. GEN:** The single tooth which represents this genus has an elongate compressed crown with two opposite simple cutting edges. Both faces are convex, the one much more so than the other. No lateral processes or denticles. The most remarkable peculiarity is in the root; it is very small, having no greater width than the crown, and contracting from the base of the crown to a truncate termination but a little distance removed from the former.

The crown of the tooth resembles that of an *Oxyrhina*, but the root is totally different. In this respect it resembles a *Dendrodus*.

**CHAR. SPECIF.:** Cutting edges of tooth continued to base of crown. Surface of crown everywhere smooth. Truncate extremity of root a crescent with obliquely truncate horns with coarsely rugose surface. Where the cutting edges are vertical their surface is below the more convex side of the crown. The root has a lateral edge at each side, which extends obliquely from below the cutting edge to the lateral angle of the truncate base, and is marked off from the base of the crown by a constriction. The base of the crown is openly emarginate by an angle of this constriction. On each side of this emargination the surface is transversely wrinkled. On the same side the root is similarly wrinkled; on the opposite side the wrinkling is less distinctly transverse.

### Measurements.

	Millimeters.
Total elevation of tooth.....	.025
Elevation of crown.....	.020
Diameters of crown above base:	
Longitudinal.....	.011
Transverse.....	.005
Diameter of root:	
Longitudinal.....	.012
Transverse.....	.006

If this species be a *Cladodont* shark, which is quite possible, it agrees with *Lambdodus* St. J. and W. in its single simple crown, but that



genus has a widely expanded horizontal root, thus differing generically from *Styptobasis*.

The *Styptobasis knightiana* was found by Mr. Wilbur C. Knight (to whom I dedicate the species with much pleasure), in what he determines as the Permian formation in eastern Nebraska. It was a large shark of carnivorous habits, and its presence indicates the existence of a marine fauna whose remains have not yet been discovered.

## II.—ON NEW ICHTHYODORULITES.

### *Hybodus regularis*, sp. nov. Fig. 2.

Dorsal spine elongate, gently curved to the apex from the middle. Anterior border rounded, posterior rather broadly truncate, the latter fissured to two-fifths the length of the spine from the base, and two and two-thirds times as far from the base as the commencement of the anterior sculpture. The sculpture of the sides descends to opposite the middle of the posterior fissure. Thus the naked inserted portion of the spine is relatively short, and the sculptured portion is long. The latter is also nearly plane. The sculptures consist of longitudinal ribs, which are similar on the front and sides of the spine. Their interspaces or grooves are as wide as the ridges on the front and the anterior half of the spine, but they become narrower on the posterior half, while the ridges are scarcely narrower. The latter are everywhere regular, and do not inosculate, but run out successively toward the extremity on the posterior side. Eight ridges may be counted on the side at the middle of the length and thirteen near the base. Bottoms of the grooves smooth. There is a wide smooth band of surface on each side of the series of teeth, which is separated by an obtuse angle from the lateral face. The teeth are small, acute, and directed downward. They form two approximated rows, the teeth of one row alternating with those of the other.

#### Measurements.

	Millimeters.
Total length (10 millimeters added for apex) .....	290
Length of smooth base in front.....	48
Length of posterior fissure.....	129
Diameters at middle of fissure—	
Anteroposterior .....	23
Transverse.....	14
Diameter (anteroposterior) at middle of length .....	23
Between apices of teeth of one row.....	10

The fine specimen on which this species is based was obtained by Jacob Boll from a soft Mesozoic limestone in Baylor County, Texas, which is probably of Triassic age. The species approaches most nearly the *Hybodus major* of Agassiz, from the Muschelkalk. In that species the teeth are stated to be mere tubercles, which is not the case in this species.

*Ctenacanthus amblyxiphas*, sp. nov. Fig. 3.

Spine elongate, but little curved, moderately compressed; the posterior face with a flat median plane bounded by a shallow groove on each side. The ridges are wider than their interspaces, and they gradually become smaller posteriorly, so as to be half the diameter of the anterior ribs. The anterior border consists of a single rib of twice the diameter of the largest lateral ribs. Its front surface is smooth; the sides are marked with shallow grooves directed downward, and the border is serrate with subacute tubercles, which point backward. The tubercles of the ribs are closely placed and vary from round to transverse in shape, and have a finely grooved surface. The line of the posterior hooks is flush with the sides of the spine. They are small, decurved, and subacute.

The apex of the spine is wanting, so I can not give its length with certainty. It was probably about  $10\frac{1}{2}$  inches. Measurements: Length of fragment, 190 millimeters; length of base presented (at front), 42 millimeters; diameters at middle, anteroposterior, 28 millimeters; transverse, 17 millimeters; transverse diameter of spine 140 millimeters, from base of fore surface 11 millimeters.

The Permian formation of Texas; W. F. Cummins.

## III.—ON THE CRANIAL STRUCTURE OF MACROPETALICHTHYS.

The typical specimen of the *Macropetalichthys rapheidolabis* Owen remains one of the best for the elucidation of the type of fishes which it represents, although it is very imperfect. It has the advantage of having lost most of the surface of the cranial ossification, so that its true structure is the more easily determined. The cavities of the cranium are occupied by the Corniferous limestone, which formation is its proper horizon, and one of the orbits contains a characteristic brachiopodous mollusc. The extremity of the muzzle is broken away obliquely, and the (?) maxillary region of the right side is lost. The matrix has been split from the inferior surface so as to show much of the structure of the latter.

The orbits are much in advance of the line dividing the superior head-shield transversely into equal halves. There are no distinct indications of the existence of hyomandibular supports of a lower jaw. There are unsymmetrical transverse sections of hollow rods, which form arcæ immediately behind the position of the orbit on the inferior fractured surface of the specimen. The fractured surfaces are suboval, and have different directions of their long axes, owing probably to different directions of pressure. This they would be liable to from the extreme tenuity of their walls. It is probable that this genus had a lower jaw. As to the upper jaw, this was probably present also, but whether it belongs to the palatopterygoid arch or to the maxillary can not be

stated. Its presence is indicated by the longitudinal transversely concave inferior surface of the element called jugal below. This articular surface might have supported some form of tooth, but as no such have been found associated with the rather abundant remains of *Macropetalichthys*, it is more probable that a distinct element was attached to this surface.

As is well known, the superior surface of the head-shield is divided into symmetrical tracts by well-marked lines. These areas have been regarded as the osseous cranial elements, and have been named by Newberry in correspondence with those of higher vertebrata.\* The lines referred to, however, are not sutures, but tubes which belong to the lateral line system; and they traverse the centers of the true bony elements instead of bounding them. They join at the centers of some of the elements, and in such cases mark the points of origin of the osseous radii, whose direction they follow. The direction of these tubes is as follows in the present species, and approximately in all the other members of the genus: In the first place there is a frontal lyra, whose branches are parallel for a distance in front of the orbits (as far as the specimen is preserved), and which begin to converge at a point a little in front of the anterior border of the orbit. They join on the middle line about half an orbit's diameter behind the line connecting the posterior borders of the same. From this point they diverge at an angle a little greater than 90 degrees to a point immediately behind the superior border of the orbit, and nearly two orbits' diameter posterior to the latter. From this point two lines diverge, one toward the externo-posterior angle of the skull, the other downwards and forwards at an angle a little over 90 degrees from the other branch. The lines are all perfectly straight except those of the lyra, which are bent just in front of the anterior border of the orbits. That these lines represent tubes is readily seen where they are broken across. That of the lyra has a subtriangular section. Below it, in front of the orbit, is a smaller one of round section which the fracture of one side enables me to trace as far as opposite the anterior border of the orbit.

In their distribution these tubes do not nearly resemble those of *Homosteus* as represented by Traquair.† A closer resemblance can be traced to those of *Coccosteus*‡, of *Dinichthys*, and especially to those of *Titanichthys*.§ The lateral branches of the frontal lyra unite posteriorly at an angle in *Dinichthys terrellii*, are slightly separated by a transverse tube in *Titanichthys agassizii*, and are more widely separated in *Coccosteus decipiens*. In all three, divergent branches extend posteriorly, as in *Macropetalichthys*. In the three forms mentioned, these posterior branches send, anteriorly and exteriorly, a branch from a point close to the posterior border of the skull, on each side. This mar-

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\* The Paleozoic Fishes of North America, 1890, p. 43.

† Geological Magazine, 1889, p. 1, pl. I.

‡ Traquair, *loc. cit.*

§ Newberry, *l. c.*, pls. I and III.

ginal tube sends a branch laterally to the external angle of the skull in all the genera mentioned, except in *Macropetalichthys*, where this point can not be demonstrated in my specimen, owing to the loss of the border. Still more anteriorly on the postorbital bone it diverges again, sending a short branch inward and one forwards in *Coccosteus* and *Titanichthys*. In *Dinichthys terrellii* it does not divide, but continues, and joins the lateral tube of the lyra. In both *Coccosteus* and *Macropetalichthys* the transverse branch extends towards the middle line. In the former it unites with that of the opposite side, and forms at its middle portion, the posterior border of the lyra. In *Macropetalichthys* on the other hand, it joins the posterior tube at an angle well behind the extremity of the lyra as already described. Thus the last-named genus resembles *Coccosteus* in this one point more than it does any of the other *Arthrodira*. (Fig. 6.)

The cranial segments discernible are as follows. They may be readily traced on the specimen, since the sculptured surface and indeed the greater part of the bone-substances have disappeared, and the cast of the inferior surface is distinctly preserved. This surface, is however, wanting from most of the top of the muzzle, so that the relations of the ethmoid elements can not be made out. From the middle of the superior border of the orbits forwards extends an element which is prefrontal or frontal; but which one the injury to the top of the muzzle does not permit me to determine. It extends down on each side of the muzzle in front of the orbit. At the anterior border of the latter, it is pierced upwards and forwards by a deep notch-like groove which receives a corresponding wedgelike anterosuperior extremity of the element which I call provisionally the jugal or malar element. This bone extends below and behind the orbit, containing in the latter region a center of radiating ossification. The median or (?) frontoparietal element encroaches on the median element of the top of the muzzle as far forwards as opposite the middle of the orbits by a convex anterior border. Its ossification radiates from the junction of the lateral branches of the lyra, in all directions, and, while its anterior and lateral borders are easily discernible, its posterior ones are not so clear. It probably extends to a point half way between its anterior border and the posterior border of the head-shield. The posterior section of the prefrontal extends obliquely backwards and is succeeded by a wide longitudinally oval element, which from its position might be termed a postfrontal, although it includes within itself the region of the postorbital. Posterior to it is a subdiscoid element of similar size, and a little wider than long, which is in the position of the supratemporal element of the *Stegocephalous* skull. Its center is the point of divergence of three tubes already described, and its ossification radiates from the same point. Exterior to this element and the one in front of it, and joining the posterior face of the malar is a large area in the position of the *Stegocephalous* squamosal element. Ossification radiates from

the posterior lateral angles of the head-shield, and there are two lines which penetrate the matrix more deeply than the rest. I can not make out that any canal radiates from this point except the one which reaches to the center of the supratemporal. This region corresponds to that of the intercalary of the fishes, but its boundaries I can not make out.

This arrangement of cranial elements may be compared with those of *Coccosteus* and *Homosteus*. It differs from the former in the presence of a malar bone bounding the orbit below, and in the presence of the "squamosal" behind it. In *Homosteus*, elements which occupy the position of the two mentioned are present (Traquair, *l. c.*), but they are called by Traquair postorbital and marginal, names which he applies to my possible postorbital and supratemporal. I think the elements described by Traquair are homologous with the malar and squamosal of *Macropetalichthys*, so that the "postorbital" (my postfrontal) and "marginal" (my supratemporal) must be sought for elsewhere in *Homosteus*. Traquair's "central" appears, from its position, to include my postfrontal, while the supratemporal may be embraced in the anterior part of Traquair's "external occipital." This question can, however, only be settled by the discovery of intermediate types. In any case, a general affinity to the *Arthrodira* is indicated by the segmental structure of the skull, as well as by the character of the tubes of the lateral line system.

The inferior surface of the skull presents the following characters. This is important, as I do not know of any description of this region in an *Arthrodire*, excepting in the cases of the *Dinichthys* and *Titanichthys* described by Newberry. (Fig. 6.)

In the first place the posterior part of the head-shield, the "median occipital" region of Traquair, is produced very far posteriorly, as in *Homosteus*. This region does not seem to have protected the brain, but rather the anterior part of the vertebral axis, and seems to have been a nuchal plate. In the specimen I am now describing, the posterior extremity of this element is broken away for a short distance on both sides of the middle line, revealing a cast of its interior. This is bilobate, by reason of a vertical constriction at the middle line. That this is not a cast of the cranial cavity is proven not only by its form, but by the fact that there is no cast representing a *medulla oblongata* or a *foramen magnum*. The chamber was absolutely closed posteriorly. The lateroposterior angle of this cavity is exposed by the loss of the external wall. It is obtusely angular. Turning now to the inferior aspect of the skull, we observed, at the middle line of the inferior-posterior border, a wide, upward excavation, looking backwards and downwards. It rapidly contracts into a groove with an angular superior middle line. Whether this groove is part of a tube can not be ascertained, owing to the loss of the bony tissue on each side and below, but it may be only the apical angle of a roof-shaped space, whose lateral slopes are produced on each side, sloping well downwards and out-

wards. These sloping faces of the matrix represent a pair of osseous plates, which descended on each side from the sheath of the myelon and chorda dorsalis, for the latter occupied this position in the groove already described. Such a structure would indicate the presence of a number of fixed vertebral elements, such as exists in the chimæras, the rays, and the sturgeons. The two-thirds of the inferior face of the skull which lies in front of this groove is covered by a single thin plate, which may be the parasphenoid. Its posterior border reaches to the anterior extremity of the roof-shaped descending plates already described, and, joining them by a rounded angle, turns downwards and outwards, the descending portion sloping forwards into the horizontal portion. Where it joins the descending plates of the axis there are three grooves on each side, which are separated by two ribs. At the point of junction of the parasphenoid with the lateral alæ of the axis, is situated what I suppose to be the foramen magnum. It is the direct continuation of the groove already described, and, being floored by the parasphenoid, has a triangular section. There is no trace here of a fossa for the chorda dorsalis, nor of an occipital condyle, nor is it probable that either existed at this point. The parasphenoid is thin, and there are no indications of teeth to be observed on it.

For the opportunity of studying this specimen I am greatly indebted to Prof. J. W. Spencer, of the University of Missouri, and to the late president of that institution, Prof. S. S. Laws, who lent it to me out of their museum.

I here describe the characters presented by another specimen of *Macropetalichthys* which belongs to the geological museum of the State of Ohio, and which was kindly lent me by the director of the survey, Prof. Edward Orton. This specimen is broken transversely across the median part of the area which includes the median occipital plate, showing that the posterior part of that area is a distinct element separated from it by suture. I call it therefore the median nuchal plate, and the two angular elements on each side of the posterior region, which are also shown to be distinct, I call the lateral nuchal elements. One of these is wanting in the specimen, showing that its junction with the median element is by a smooth squamosal suture. The anterior face of the nuchal mass has a vertical groove on the middle line which fits a corresponding keel of the cranium proper. The triangular foramen magnum issues at the inferior extremity of this keel; at the lateral extremity of this occipitonuchal suture under the free lateral margin of the skull is a fossa, one-half of which is in the cranium and one-half in the nuchal element. This looks like an articular glenoid cavity, possibly for the condyle of a mandible. It is bounded posteriorly by a transverse crest, posterior to which is the extensive longitudinal fossa beneath the free border of the nuchal plate. There is a small fossa on the middle line 20 millimeters in front of the occipitonuchal suture, in the parasphenoid bone. The anterior part of the skull is better preserved than in

the skull of the *M. rapheidolabis* first described. The borders of the muzzle are bounded on each side by a shallow longitudinal fossa, which looks outward and downward. Each is bounded on the inner inferior side by a longitudinal crest which looks downwards and extends backwards and outwards. The palate between these ridges is concave from side to side. The median portion is filled with matrix so that the surface and its relations with the parasphenoid can not be seen. The lateral ridges are continued to below the orbit. In front of the supposed glenoid fossa is another longitudinally oval fossa below the edge of the skull. The chordal groove and the laminar plates descending on each side of it are as in the specimen first described.

The lateral nuchal element is separated from the median, so as to show that the latter has an approximately semicircular outline when seen from above. Viewed from behind, the nuchal element displays an obtuse median vertical keel with a shallow fossa on each side, bounded by an angle on each side at the superior margin, but fading out below. The vertical diameter is considerably greater relatively than in the *M. rapheidolabis*. I suspect that the specimen belongs to the *M. sullivantii* Newb.

Returning to the *M. rapheidolabis* I observe that the anterior borders of the descending axial alæ are about opposite to the lateral center of radiation of the lateral line tubes, or the center of the so-called supratemporal bone. Below the anterior border of the orbit, on each side of the middle line, about 7 centimetres apart, is a pair of medium-sized round foramina. Exterior to these, a little anteriorly, at double the space between the two median foramina, is another pair of foramina of oval section, which look outward, forward, and downward. The bony wall of the neural canal, already described, is quite thick.

There is no trace of pineal foramen such as is described by Newberry in Dinichthyidæ. The sclerotica was protected, but whether by a thin extension of the prefrontal and postfrontal bones or by a special ossification is not determinable. The impression only remains. A considerable fossa is inclosed between the descending axial plates and the lateral borders of the posterior part of the head-shield, which opens downward and outward. The sculpture of the surface of the skull is preserved in one or two places. It consists of round, flattened, rugose tubercles of a diameter of about 2 millimeters placed close together.

*Affinities of Macropetalichthys and of the Arthrodira.*—It has been shown by Agassiz that Coccosteus has a mandibular arch, and by Newberry that this region is present in the Dinichthyidæ. Traquair has also shown that in the former genus it is connected with the cranium by a suspensorium. Free elements beneath the anterior part of the head-shield have been demonstrated to exist in Homosteus by Traquair, which probably include a mandibular arch. The general resemblance of Macropetalichthys to the Arthrodira renders it almost certain that it possesses a lower jaw, and that it is a member of that order. I have

included this order in the Crossopterygia with doubt\* on the supposition that they possess a maxillary arch and suspensorium. The former is however not described so as to distinguish it from a palatopterygoid arch by authors, and no evidence of the existence of such an arch can be derived from American forms. Advance sheets of volume II of the Catalogue of Fossil Fishes in the British Museum, by A. Smith Woodward, show that this able authority places the Placodermata in the Dipnoi, thus indicating that they possess neither maxillary arch nor suspensorium.

There is much in the structure of the skull of *Macropetalichthys* to confirm this opinion. The nuchal portion of the structure with its lateral nuchal elements is represented by the cartilaginous mass which extends posterior to the median occipital bone in *Ceratodus*, in which this region has very much the form of the nuchal shield in *Macropetalichthys*, although it is relatively shorter. The chordal groove with its descending laminae resembles much the produced occipital bone of *Lepidosirem*. The parasphenoid in both *Lepidosirem* and *Ceratodus* are produced posteriorly abnormally, and it is only necessary to imagine this part to be reduced to its normal length to have the conditions found in *Macropetalichthys*. The broad parasphenoid and vomer remind one of that of *Otenodus*. As I have shown that *Macropetalichthys* is allied to *Dinichthys*, we can add in favor of the supposition of affinity to the Dipnoi the peculiar dentition of that genus. The ectetramerus† structure of the dorsal fin shown by Von Koenen and Traquair to exist in *Coccosteus*, and shown to be probably present in *Dinichthys* by Newberry, are in favor of the Dipnoan theory. Elements supposed to be the axial elements of pectoral fins are described by Dr. Newberry. These are simple and without lateral articulations, and are thus of the unibasal type which is general in Dipnoi as well as in some Crossopterygia and all Rhipidopterygia. They somewhat resemble those which I shall describe in this paper as characteristic of *Megalichthys*. It is on account of this part of the structure that the *Arthrodira* can not be arranged near to the sturgeons, where *Macropetalichthys* has been placed by Newberry and others, to say nothing of the cranial structure, which has no resemblance to that of those fishes.

I first referred *Macropetalichthys* to the Placodermata (*Arthrodira*) in a review of Professor Newberry's work on the Paleozoic Fishes of North America in the *American Naturalist* for September, 1890; and this view has been adopted by Mr. A. Smith Woodward as above mentioned.

*Species of Macropetalichthys*.—It is evident that the two crania which I have described in the preceding pages belong to two different species. The larger is the *M. rapheidolabis* of Owen, and the smaller the *M. sullivantii* Newberry. In the latter the nuchal element and its included

\* Synopsis of the Families of the Vertebrata, *American Naturalist*, October, 1889.

† Cope, *American Naturalist*, 1890, p. 416.



chamber have a greater depth in proportion to the width and length of the skull than in the former. They may be characterized as follows:

Posterior nuchal depth  $\frac{1}{4}$ th width and  $\frac{1}{8}$ th length of skull above; *M. rapheidolabis*; fig. 4.

Posterior nuchal depth entering width behind  $2\frac{1}{2}$  times and length  $4\frac{3}{4}$  times; *M. sullivantii*; fig. 5.

The skull of the *M. sullivantii* is rather narrower than that of the *M. rapheidolabis*.

The half width at the foromam magnum enters the length to the anterior border of the lateral marginal fossa  $3\frac{1}{2}$  times, while it enters but 3 times in the *M. rapheidolabis*.

#### IV—ON THE PECTORAL LIMB OF THE GENUS *HOLONEMA* NEWBERRY.

Described from fragmentary or single plates by Claypole and Newberry, the *Holonema rugosa* Claypole remained a vertebrate of uncertain affinities. At the meeting of the American Association for the Advancement of Science held at Indianapolis, August, 1890, Prof. H. S. Williams exhibited photographs of the posterior part of the carapace of a newly discovered specimen, which includes the greater part of the two median dorsal plates and the posterior laterals. The rounded posterior outline of the carapace is similar to that seen in *Bothriolepis*, and neither this nor any of the specimens described up to that time demonstrate the distinctness of this form from that genus.

In the collection of Mr. R. D. Lacoe, of Pittston, Pennsylvania, which that gentleman kindly placed at my disposal, there are specimens of this genus from Mansfield, Tioga County, Pennsylvania. The largest of these is a lateral plate of the plastron, partly represented by a very distinct mold of the matrix. It measures 190 millimetres in length and 105 millimetres in width. Besides this, there is a nearly complete pectoral spine, which is of much interest, as this part of the skeleton has not been previously known. (Fig. 7.)

This spine belongs to a smaller individual than any of those of the *Holonema rugosa* yet described, but until the range of dimensions of that species is known it will not be safe to regard it as representing another species. The range of size of the *Bothriolepis canadensis* is very considerable. The spine differs from that of both *Bothriolepis* and *Pterichthys* in being without complete segmentation. It is continuous throughout to the apex. This, then, will constitute the generic distinction so far known between *Holonema* and *Bothriolepis*. The tissue of the spine is disposed in tesserae, as in the other genera allied. A single series of three elongate narrow hexagons extends down the center of the external face, and the lower space is divided by sutures, which extend from the lateral angles of the hexagons to the border of the spine. The apex of the spine from the last hexagon, and for a length nearly equal to it, is not tessellated.

The spine is nearly straight and tapers symmetrically to an acute apex. The head is rounded and looks slightly inwards, and its surface is slightly produced inwards and backwards in a low free angle. The inner edge of the spine is armed with a row of tooth-like processes about twenty-two in number, which are directed backwards. There are no teeth on the external edge of the spine. The surface is thrown into rather coarse obtuse somewhat irregular longitudinal ridges, which inosculate more or less, and resemble in general that of the plate of the shell of the *Holonema rugosa*. Eight or nine ridges may be counted at the middle of the length of the spine. Length of spine 54 millimetres, width at base 11 millimetres, at middle 7 millimetres.

From Mansfield, Pennsylvania, collected by A. C. Sherwood for R. D. Lacey.

#### V.—ON THE PAIRED FINS OF *MEGALICHTHYS NITIDUS* COPE.\*

This species was referred by me to a genus distinct from *Megalichthys* on account of the annular ossification of the vertebræ, those of the latter genus having been described by an English authority as amphicæalous. Dr. Traquair has, however, shown that the vertebræ of the *Megalichthys hibernii* are annular, and specimens kindly sent me by Mr. John Ward, of Longton, Staffordshire, and identified as belonging to that genus, quite resemble those of the *M. nitidus*. I therefore provisionally, at least, withdraw the generic name which I conferred on the latter. It is not uncommon in the Permian bed of Texas. (Fig. 8.)

I have described the basis of the posterior part of the skull in this species and in the smaller *M. ciceronius* Cope,† and I can now give an account of the characters of the limbs. I am enabled to do this by making longitudinal sections of both anterior and posterior limbs of both sides of the fine specimen of the *M. nitidus*, which served as the type of my original description. (Fig. 9.)

The paired fins or limbs are of the "obtusely lobate" type according to Woodward, but approach those of the *Artbrodira* very distinctly. The general form is short for a fin of the unibasal type, as it is fusiform, terminating in a rather rapid acumination. The superior, exterior, and inferior faces are covered with small scales covered with ganoine, and the rays are confined to the internal edge. The axis of the pectoral fin consists of a single robust element, probably cartilaginous, but invested with a thin layer of dense bone. The interior structure is cellular, the cells of irregular amœbiform outlines, and surrounded by a distinct layer colored like the matrix, and not like the osseous tissue. This element extends to the extremity of one of the fins which has unfortunately lost its apex. On the other it disappears at three-fifths the distance from the base, owing probably to the obliquity of the section. On the in-

\* *Ectosteorhachis nitidus* Cope. Proceed. Amer. Philos. Soc., 1880, p. 56.

† Loc. cit., 1883, p. 628.

ternal border of the fin on both sides short and undivided parallel rays diverge towards the body.

It is evident that this fin does not resemble that of *Ceratodus*, nor that of any of the unibasal fins of the distichous type. The axial element is not segmented, unless it be near to the extremity, nor is it branched. It supports simple rays alone, and these at the internal edge only.

The section of the ventral fin shows, like the pectoral fin, rays on the internal border, and also at the extremity. There are none on the external border, where the axial bones are close to the integument. The base of the pubis is exposed. The extremity is concavo-truncate, is coarsely cellular within, and is bounded by a thin external bony layer. Like the pectoral fin, the greater part of the ventral axis is occupied by a single element, which is rod-like, slightly constricted medially, and truncate at the extremities. The proximal extremity equals less than half of that of the pubis, but it constitutes the axis of the limb, as may be readily seen by reference to the external form of one of them. This fin is bent at this articulation, and is bent again at the extremity of the axial rod, beyond which the apex tapers rather rapidly. The section shows no second axial segment in the distal part of the main axis, but two pairs of nodules and distad of these two transverse rows of segments of three radii, more distal segments being lost. Those of the proximal row are longer than those of the distal one, and the external are the most robust. The structure resembles that of a Batrachian tarsus or carpus rather curiously; but this may be due to the position of fractures of the radii distad to the axial rod. Another cartilaginous, bony-sheathed segment appears in this fin, which is half the dimensions of the principal one and projects a little beyond it on its inner side, lying parallel to and close to it. It is followed, after an interspace, by seven radii which lie closely parallel, and soon terminate, probably owing to injury. Each is divided into two or three segments, but whether normally or abnormally can not be stated. There is no segment connecting this one with the pubis, but there is a rounded extremity of possibly a short stout segment opposite the extremity of the latter, within the proximal extremity of the principal axial segment. Whether this fin is unibasal or pluribasal remains therefore uncertain; but if there be more than one elemental axis, there are not more than two.

It remains therefore demonstrated that the fin structure in *Megalichthys* is very simple, and does not in the least resemble that of *Polypertus* on the one hand nor that of *Ceratodus* on the other. It seems to be intermediate in character between that of the latter genus and that of *Pterichthys*, or perhaps that of the imperfectly known *Arthrodira*.

## VI.—ON THE NON-ACTINOPTERYGIAN TELEOSTOMI.

Material is not at present accessible in the United States from which to learn the structure of the median fins in the *Holoptychiidæ* and *Osteolepididæ*. In drawing up my synopsis of the Families of the Vertebrata, in 1889\*, I assumed that these fins had the primitive structure, such as is found in the oldest members of the Teleostomi (*Tarassiidæ*), *Dipnoi*, and other subclasses, viz, that the axonosts are equal in number to, and continuous with, the neural spines of the Vertebrata. This definition threw the families in question into the Crossopterygia as distinguished from the Rhipidopterygia. In the latter the axonosts are much reduced in number, so that one or two fused into a single piece supports each dorsal and anal fin.

Professor Traquair has, however, stated that the dorsal fins of the *Osteolepidæ* are of the Rhipidopterygian type, and Mr. A. Smith Woodward, in vol. II of the Catalogue of Fossil Fishes in the British Museum,† confirms this statement, and shows that the *Holoptychiidæ* agree with them in this respect. He does not adopt the superorder Rhipidopterygia, but combines it with the Crossopterygia, and he places the families mentioned, together with the *Rhizodontidæ*, which is my *Tristichopteridæ*, in the order to which I referred the latter, the Rhipidistia. As regards this original reference, it is clearly necessary on the evidence brought forward by Traquair and by Woodward. I do not see, however, that the Rhipidopterygia can be properly combined with the Crossopterygia, since the structure of the median fins is radically different, and one which offers as good ground for superordinal distinction as do the paired fins offer ground for the separation of the Actinopterygia. The *Tarassiidæ* and the *Polypteridæ* possess the characters of the median fins which I viewed as characteristic of the Crossopterygia, while the paired fins, so far as can be discovered from the descriptions of the former,‡ indicate two distinct orders within it.

With this new information in our possession, it appears to me that the relations of these fishes are best expressed in the following way :

There are four superorders of the Teleostomi, or true fishes, which differ in the structure of the fins :

- I. Median fins each with a single bone representing axonosts.  
     Paired fins unibasal ..... *Rhipidopterygia*
- II. Median fins with numerous axonosts.  
     Paired fins with baseosts; pectorals with axonosts, which are distinct from baseosts ..... *Crossopterygia*  
     Paired fins with baseosts; pectoral fins with axonosts and baseosts confounded; pluribasal ..... *Podopterygia*  
     Pectoral fins only with baseosts, these confounded with axonosts and pluribasal ..... *Actinopterygia*

\* American Naturalist, p. 856.

† Smith Woodward, l. c. II., p. 317.

‡ L. c., 1891, p. 321.

## RHIPIDOPTERYGIA.

The orders of Rhipidopterygia are the following. They all have actinotrichia in place of fin-rays:

I. Paired fins with the basilar arranged on each side of the median axis, or archipterygial.

Median fins with basilar.....*Taxistia*

II. Paired fins with the basilar arranged fan-shaped at the end of the short axis.

Median fins with basilar.....*Rhipidistia*

Median fins without, caudal fin with, basilar.....*Actinistia*

The *Taxistia* includes but one family, the *Holoptychiidae*, which is of Devonian and Carbonian age. The *Rhipidistia* includes the *Tristichopteridae* from the Devonian and Carbonian; the *Osteolepidae* from the same, and possibly the *Onychodontidae*, which are Devonian.

The *Actinistia* includes the single family of the *Cœlacanthidae*, which appears in the Lower Carbonian and ranges to the Upper Cretaceous in both Europe and America.

In all of the Rhipidopterygia the tail is either heterocercal or diphyrcercal and the chordadorsalis persists. The scales have a layer of ganoin, which extends also on the head. The latter has a well-defined persistent transverse suture separating the parietal from the frontal elements.

The *Crossopterygia* includes two orders, as follows:

Baseoste and axonoste well developed; actinotrichia; no fin rays; pectorals unibasal.....*Haplistia*

Baseoste rudimental; fin rays; pectorals tribasal.....*Cladistia*

But one family is included in the *Haplistia*, the *Tarasiidae*, from the Lower Carbonian of Scotland. The *Cladistia* are represented by a family which is not known in the fossil state, the *Polypteridae* of the rivers of Africa. The vertebrae in this genus are ossified and biconcave.

The *Podopterygia* has also two orders. They are thus defined:

Branchiostegal rays present.....*Lycopteri*

No branchiostegal rays.....*Chondrostei*

In these orders the notochord is persistent, and there are either actinotrichia or fin-rays which are more numerous than the baseoste. Tail heterocercal or diphyrcercal.

## VII.—ON NEW SPECIES OF PLATYSOMIDÆ.

*Platysomus palmaris* sp. nov.

This species is represented by about a hundred fragments of bodies of various sizes, some of which include the scapular arch, but none the fins. All the fragments are covered with scales, and in a number of them the median line of the belly is preserved. In the scapular arch the character of the allied forms is observed in the presence

of a closely fitting interclavicular bone which bounds the recurved inferior extremity of the clavicle on each side. The anterior face of the clavicle is expanded inwards below, so as to be wider than the external face, and its inner edge is in contact with the corresponding edge of the opposite clavicle, so as to inclose a short tube with the interclavicles. The scales of the inferior row differ from the others in having only half the diameters of the others, so that two scales are articulated to the inferior edge of each scale of the next to the bottom row. Each of these narrow vertical scales of the inferior row sends up an acute process which fits a corresponding pit in the scale of the row above it. This character resembles what is seen in the genus *Benedenia* Traquair in a general way. There are two such rows of scales in the type of that genus, *B. deneënsis* Traqu., and I can not make out from Traquair's figure and description whether they are longitudinally fissured or not. The figure represents vertical grooves, which may be sutures. The decision of this point must depend on further examination. I place this species provisionally in the genus *Platysomus*, but I do not find this character to be described in other species of the genus, according to the descriptions of authors.

The scale-series tend slightly backward from the vertical below, without distinct curvature. The scales on the sides in front are about five times as deep as long, and they graduate in size to the lowest undivided row, where they are about twice as deep as long. The small scales of the inferior row are twice as deep as long, and their depth is about half that of the scales of next series above them. The sculpture of the scales consists of narrow vertical ridges, which are curved slightly backwards below. About ten may be counted crossing a transverse line on each scale. Each of the narrow scales of the inferior row possesses a median angular keel which extends from the anterior edge downwards and backwards, but which does not reach the posterior edge of the scale. The external face of the clavicle is vertically striate like the scales, and horizontally striate on the recurved portion. The interclavicle has more distant longitudinal ridges, and one ridge on each side of the low median keel is broken up into enamel tubercles.

The body is acute below. This is always the case, whether the fragments are compressed or not.

#### Measurements.

	Mm.
Diameters of anterior median scale:	
Anteroposterior .....	2
Vertical .....	10
Diameters of lowest normal scale:	
Anteroposterior .....	3
Vertical .....	4
Depth of scale of inferior border (specimen No. 2).....	2.5
Length of interclavicle (specimen No. 3).....	10
Width of interclavicle in front (No. 3).....	8
Diameter of interclavicular tube, transverse (No. 3) .....	7

From the Permian bed of the southern Indian Territory. Collected by W. T. Cummins.

I have been principally guided in the determination of this form by the monograph of the *Platysomidæ* published by Dr. Traquair, in the Transactions of the Royal Society of Edinburgh, vol. 29, p. 343. Dr. Traquair there demonstrates clearly that the *Platysomidæ* belong to the *Lysopteri* near to the *Palæoniscidæ*, and that they are not allied to the *Dapediidæ*.

*Platysomus lacovianus* sp. nov.

Radial formula: D. 28, C. 30, A. 25. Body deep, superior and inferior outlines very convex, superior convexity posterior to the inferior. Scales in nearly vertical series of few in a series, each scale with about nine closely placed parallel ridges. These are parallel to the sides of the scales in the lower and middle parts of the body, but on the superior regions they are directed forwards as well as downwards, being oblique to the long axis of the scale. The ventral border is furnished with a single series of scales with a free acute extremity, forming a serrate line. No such series is noticed on the dorsal outline. The head is badly preserved; the pterotic and post-frontal regions have a striate sculpture like that of the scales.

*Measurements.*

	Mm.
Length of specimen.....	37
Greatest depth of specimen.....	22
Length of base of dorsal fin.....	7

This species is probably allied to the *Platysomus circularis* M. & W.\* In it the radial formula is given at D. 40, C. 30, A. 30. The scales are also said to be smooth. This may be an appearance only, due to the loss of the ganoine layer; but if correctly stated the scales are very different from those of the *P. lacovianus*.

The typical and only specimen of the *P. lacovianus* is preserved in the cabinet of Mr. R. D. Lacoe, of Pittston, Pennsylvania, to whom I am indebted for the opportunity of examining it. It is in a concretion from the Coal Measures of Mazon Creek, Illinois.

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\* Report of the Geological Survey of Illinois, p. 347, Pl. iv, Fig. 2.

## EXPLANATION OF PLATES.

## PLATE XXVIII.

Fig. 1. *Styptobasis knightiana* Cope, tooth natural size; fig. 4 base view.

Fig. 2. *Hybodus regularis* Cope,  $\frac{1}{3}$  nat. size, left side; *a* section of middle of posterior groove; *b* is at middle of closed portion.

Fig. 3. *Ctenacanthus amblyxiphius* Cope, about  $\frac{1}{2}$  nat. size; right side, both extremities lost; *a* front view; *b* section at open groove; *c* section at broken apex,  $\frac{1}{2}$  nat. size.

## PLATE XXIX.

Fig. 4. *Macropetalichthys rapheidolabis* N. O. & E. type; skull one-third nat. size; 1 from above; 2 from below; 3 posterior view. Lettering; *P<sub>eo</sub>* preorbital; *P<sub>lo</sub>* post-orbital; *c* central; *sq* squamosal; *Sp* supratemporal; *E<sub>o</sub>* exoccipital; *Mo* median occipital; *Mc* ♀ maxillary or malar; *Pa* parasphenoid; *nc* chordal canal.

## PLATE XXX.

Fig. 5. *Macropetalichthys sullivantii* Newb., cranium,  $\frac{1}{2}$  nat. size; 1 from below; 2 from behind; front of cranium proper from behind at suture with unchal shield.

Fig. 7. *Holonema* sp. pectoral spine, nat. size.

## PLATE XXXI.

Fig. 6. Diagrams of superior sides of head shields of Dinichthyidae. 1 *Dinichthys terellii* Newb.,  $\frac{1}{4}$  natural size, 2 *Titanichthys agassizii* Newb.,  $\frac{1}{4}$  nat. size; both from Newberry.

Fig. 11. *Platysomus lacovianus* Cope,  $\frac{1}{2}$  nat. size; a vertical band of scales showing sculpture.

## PLATE XXXII.

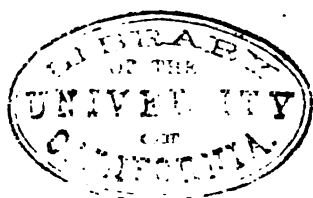
Fig. 8. *Megalichthys nitidus* Cope, type; about  $\frac{2}{3}$  nat. size. Fig. 1 head and part of body from below; 2 head from above; 3 head from side; 4 head from front.

Fig. 9. *Megalichthys nitidus* Cope, sections of fins; 1 of left fore fin; 2 of right hind fin, both from below; nat. size.

## PLATE XXXIII.

Fig. 10. *Platysomus palmaris* Cope, parts of 3 individuals, nat. size; 2a-b inferior parts of plate band, from 2, enlarged; 3a-b front and inferior views of scapular arch from 3, *cl* clavicle; *Icl* Inter-clavicle.





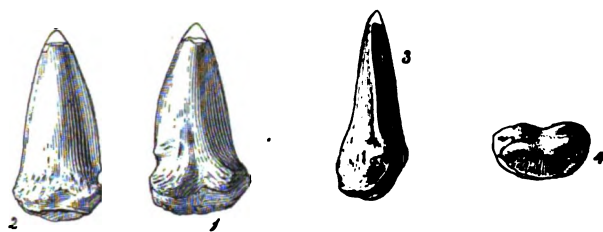


Fig. 1.

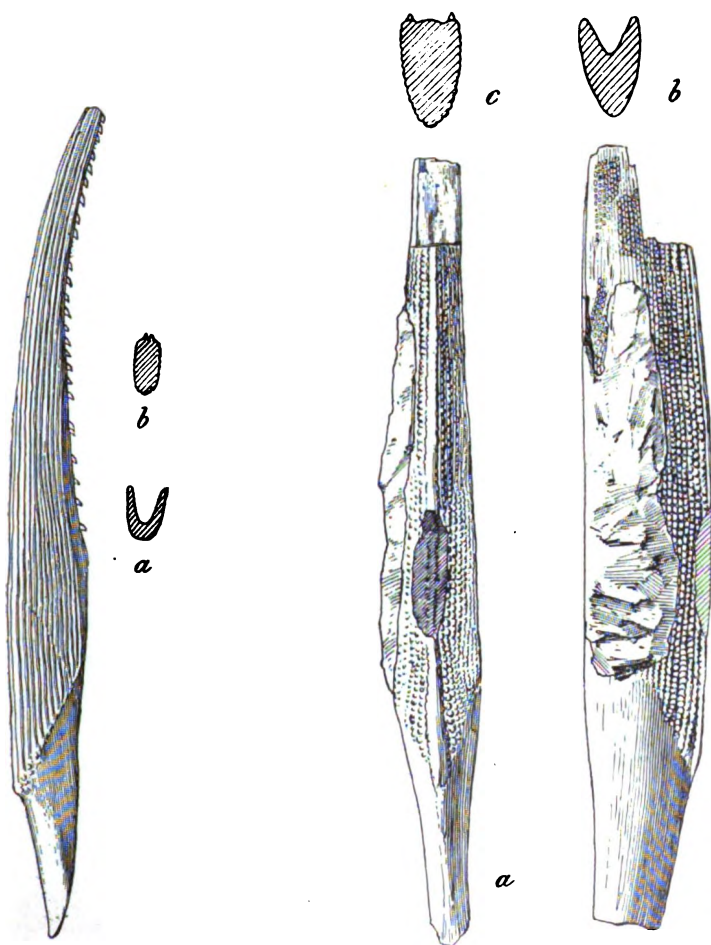


Fig. 2.

Fig. 3.

FIG. 1. *Styptobasis knightiana* Cope.  
FIG. 2. *Hybodus regularis* Cope.  
FIG. 3. *Ctenacanthus amblyrhipias* Cope.



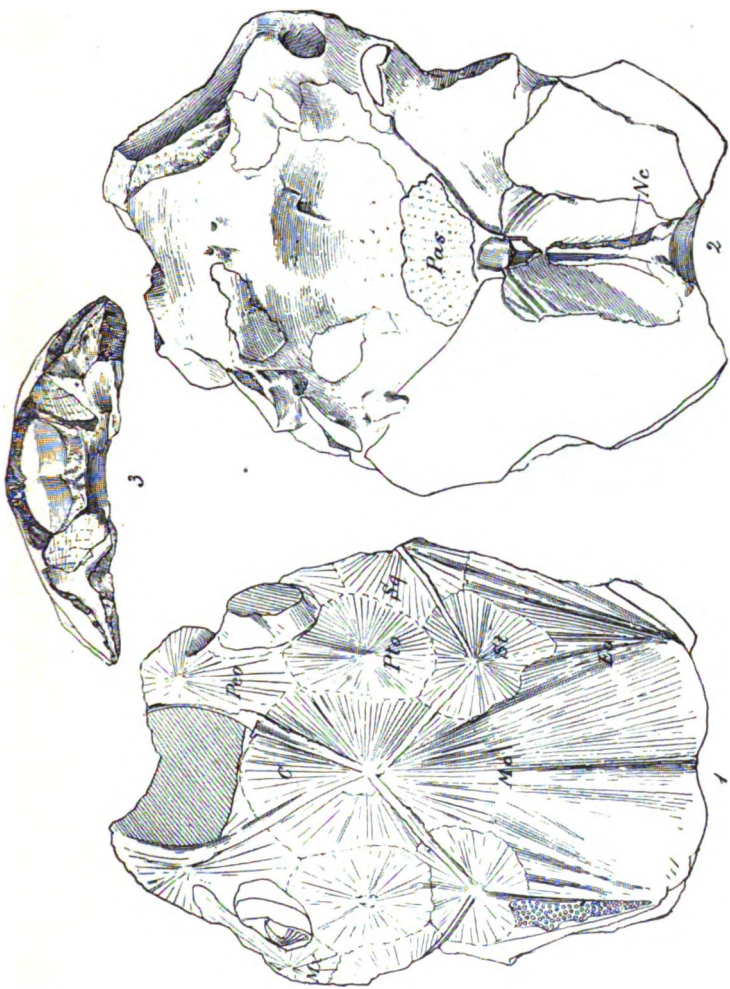


FIG. 4. *Macropetalichthys raphetolabis* N. O. & E.





FIG. 5. *Macropetalichthys sullivanti* Newb.  
FIG. 7. *Holomena* sp.



FIG. 7.



3

FIG. 5.



2



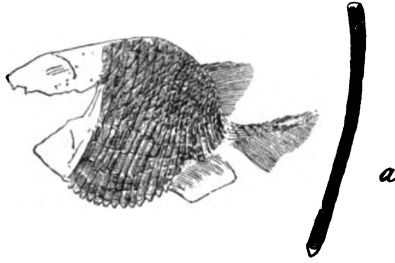


Fig. 11.

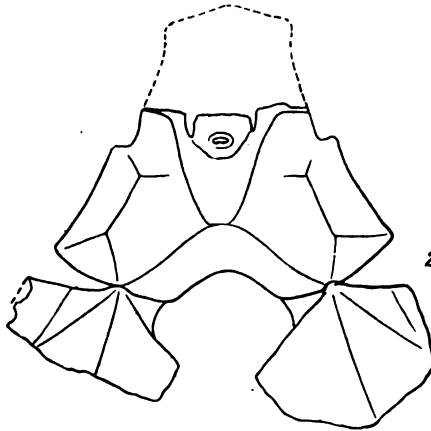
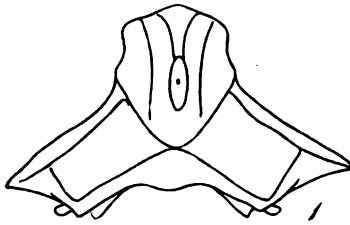


Fig. 6.

FIG. 6. (1) *Dinichthys*; (2) *Titanichthys*.  
FIG. 11. *Platysomus lacorinus* Cope.





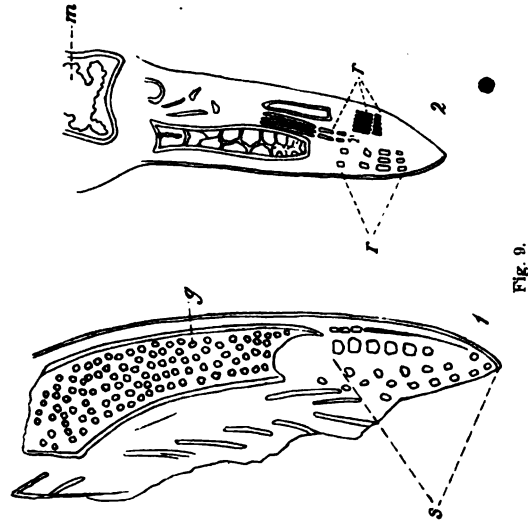


Fig. 9.

Fig. 8.

FIGS. 8, 9. *Megalichthys nitidus* Cope.



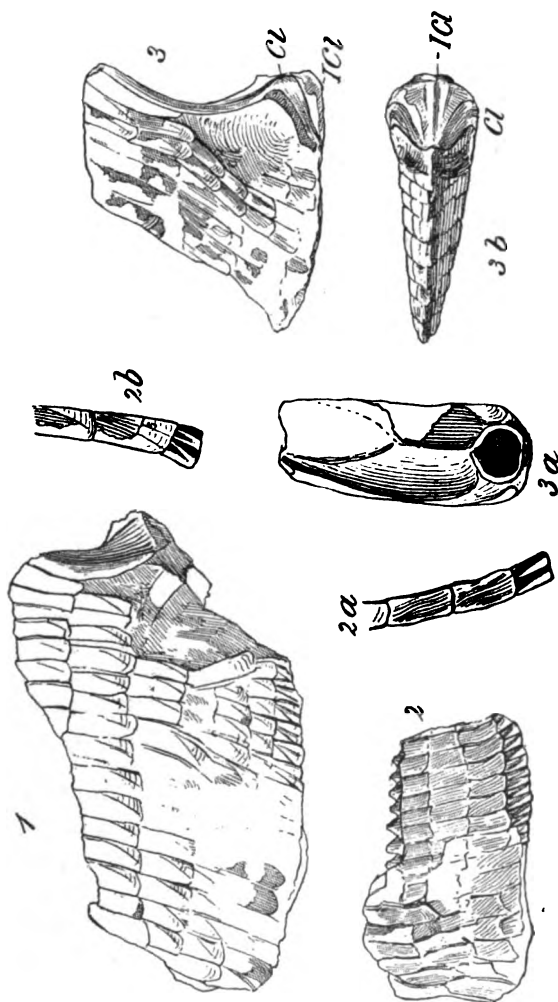


FIG. 10. *Platyomus palmaris* Cope.

ALIFORNIA

DESCRIPTION OF A NEW SPECIES OF WHIPPOORWILL FROM  
COSTA RICA.

BY

R. RIDGWAY,

*Curator of the Department of Birds.*

*Antrostomus rufomaculatus*, sp. nov.

**SP. CHAR:** Primaries black, uniform on inner webs, spotted with rusty on outer webs; tail black, banded with light rusty, the three outer feathers (in male) broadly tipped across both webs with white. Plumage in general black, spotted with light rusty, the spots usually of transverse form, and on the posterior under parts broader and paler; on the belly a few larger spots of buffy whitish. No white on throat. Length (skin), about 8.75; wing, 6; tail, 4.60.

**HABITAT:** Costa Rica (Volcan de Irazú).

*Adult male* (No. 120102,\* U. S. National Museum, Volcan de Irazú, Costa Rica, April 11, 1891, Anastasio Alfaro): General color black, but this much variegated by numerous rather small spots, mostly transverse, of light rusty or cinnamon-rufous; the top of the head, however, with several broad irregularly serrated stripes of uniform black; four middle tail-feathers with about ten broad  $\Lambda$ -shaped bars of cinnamon-rufous, averaging narrower than the black interspaces, and themselves more or less broken by irregular small blotches of black; three outermost tail-feathers on each side, with the cinnamon-rufous bars much narrower, less broken, directly transverse, and becoming obsolete towards the ends of the feathers, which for the space of 0.65 (on the outermost) to 0.90 (on the third) are silky white entirely across both webs, including the shaft; the terminal margin of the white patch, however, tinged with ochraceous. Inner webs of all the remiges (except innermost secondaries) entirely black; outer webs marked with small spots of cinnamon-rufous, on secondaries along the margin only. Anterior half of lower parts black, each feather marked with a terminal pair of small spots of pale cinnamon-brown or russet; these, across lower part of throat larger, coalesced into a single  $\nabla$ -shaped bar on each feather, but not forming a distinct throat-patch; middle of breast with three transversely pandurate spots of dull buffy whitish, considerably larger than the other markings. A band or belt of similar large light-colored spots

\* No. 5401, Museo Nacional de Costa Rica.

Proceedings National Museum, Vol. XIV, No. 867.

across the sides and middle of the belly, posterior to which the prevailing color is pale cinnamon-brown (more clay-colored or buffy on under tail-coverts), marked with transverse spots or irregular bars of blackish. Under wing-coverts dusky, indistinctly spotted on outer margin of wing with dark rusty; bill entirely black; feet blackish, becoming pale brownish (dull flesh color in life) on upper and posterior portion of tarsus. Length (skin), about 8.75; wing, 6.00; tail, 4.60; culmen, 0.35; tarsus, 0.62; middle toe, 0.60. Second and third quills longest; fourth longer than the first, but the latter very much longer than the fifth. Tail much rounded, the lateral feathers 0.70 shorter than the middle pair.

This very distinct species is a true *Antrostomus*, agreeing very closely with *A. vociferus* in size and proportions, but strikingly different in coloration. In the last mentioned respect it seems to come somewhat near *A. sericeo-caudatus* Cass.,\* supposed to come from South America (Venezuela?), but the latter is much larger (length 11 instead of less 9.00, wing 7.25 instead of 6.00, tail 5.75 instead of 4.60), much paler or more rufescent in color, and has the tail-bars exactly the reverse in position, being V-, instead of A-shaped. No other species of the genus appear to resemble it at all closely.

For the privilege of describing and naming this fine new species, I am indebted to the courtesy of Señor Anastasio Alfaro, the accomplished director of the Costa Rica National Museum.

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\* Cf. Proc. Ac. Nat. Sci. Phila., iv, 1849, 238; Jour. Ac. Nat. Sci. Phila., ii, 1852, 121, Pl. 12.

## NOTES ON SOME BIRDS FROM THE INTERIOR OF HONDURAS.

BY

ROBERT RIDGWAY,

*Curator of the Department of Birds.*

A collection of nearly two hundred specimens (representing eighty-five species), obtained in the interior of Honduras by Mr. Erich Wittkugel, and purchased by the U. S. National Museum, contains the following birds of special interest:

### 1. *Platypsaris aglaiae hypophæus*, subsp. nov.

**SUBSP. CHAR:** Similar to *P. a. latirostris* (Bonap.), but male darker above (the back grayish black, very little different from the head), the gray of under parts deeper and much more uniform, without the slightest indication of paling on the throat or chest, and white on inner webs of remiges much more restricted (none at all on first primary); the female also darker than that of *P. a. latirostris* (deep tawny-buff, instead of pale cream-buff, beneath).

**HABITAT:** Interior of Honduras (San Pedro Sula).

*Adult male* (type, No. 120293, U. S. Nat. Mus., San Pedro Sula, Honduras, October 4, 1890; Erich Wittkugel): Pileum deep black, slightly glossed with greenish, the feathers grayish beneath the surface, the forehead dull smoky black; hind neck glossy grayish black, fading into dull blackish slate on the back, the rest of the upper surface being deep slate-gray; concealed portion of scapulars largely pure white, partially exposed when feathers are disarranged. Lower parts entirely uniform gray (intermediate between the gray No. 6 and the olive-gray of my *Nomenclature of Colors*). Outer primary without any white at base of inner web. Upper mandible black, lower plumbeous-dusky; feet plumbeous-dusky. Length (skin), 6.30; wing, 3.45; tail, 2.60; exposed culmen, 0.65; tarsus, 0.80; middle toe, 0.48.

Another adult male (No. 120294, same locality and collector, January 2, 1891,) is similar to the one described except that it is still darker, both above and below, the entire back being quite black (though less glossy than the top of the head), while the sides of the head and neck also are nearly black. Its measurements are as follows: Length (skin), 6.25; wing, 3.50; tail, 2.57; exposed culmen, 0.67; tarsus, 0.82; middle toe, 0.50.



*Young male, transition plumage* (No. 120295, Santa Ana, Honduras, November 6, 1890; Erich Wittkugel): Similar to the adult male, as described above, but outer surface of closed wings chiefly bright rusty chestnut under wing-coverts tawny-ochraceous, inner web of remiges broadly edged with ochraceous-buff (occupying entire web of secondaries, except at tips), and gray of under parts, especially posterior to the breast, much intermixed and stained with pale buffy. Under mandible light colored. Length (skin), 6.25; wing, 3.45; tail, 2.45; exposed culmen, 0.62; tarsus, 0.80; middle toe, 0.45.

*Young male—first year?* (No. 120296, U. S. Nat. Mus., San Pedro Sula, Honduras, January 28, 1891; Erich Wittkugel): Pileum and hind neck black, becoming dull grayish dusky on forehead; back and scapulars, grayish olive, mixed or stained with dull rusty brownish, some of the feathers having dusky shafts; rump and upper tail-coverts dull rusty cinnamon, slightly tinged with olive; rectrices clear tawny cinnamon-rufous, some of them darker or browner, others with dusky longitudinal blotches; wings chiefly cinnamon-rusty; their under coverts, clear ochraceous-buff. Under parts mixed olive-grayish and buff, the former prevailing on sides of breast. Under mandible brownish white. Length (skin), 6.30; wing, 3.35; tail, 2.55; exposed culmen, 0.65; tarsus, 0.78; middle toe, 0.50.

*Adult female* (No. 120298, U. S. Nat. Mus., San Pedro Sula, Honduras, November 29, 1890; Erich Wittkugel): Pileum smoky grayish black, fading on forehead into dull grayish brown ("hair brown"); rest of upper parts dull cinnamon-chestnut, brighter (almost cinnamon-rufous) on greater wing-coverts, secondaries and tail, as well as around neck. Lores light grayish; malar region, deep buff or clay color, gradually becoming deeper and more rusty posteriorly until it merges into the bright cinnamon-rusty of sides of neck. Chin, pale buff; rest of under parts deep tawny-buff or clay-color, the under wing-coverts ochraceous-buff. Under mandible, dusky grayish (plumbeous in life?). Length (skin), 6.40; wing, 3.25; tail, 2.40; exposed culmen, 0.65; tarsus, 0.80; middle toe, 0.50.

I think there can be no question as to the distinctness of this bird from *P. a. latirostris*, of which the National Museum possesses two adult males and an adult female, from Ometepe, Nicaragua, collected by Mr. C. C. Nutting. The male of *P. latirostris* is much paler throughout, having the distinctly gray back sharply defined against the black cap, and the white on the inner webs of the primaries very much more extended, there being a considerable white space on the basal portion of the first quill, of which there is no trace in the two adult males of *P. a. hypophæus*. The short second primary is likewise considerably narrower than in *P. a. latirostris*.

The adult female is very much darker than that of *P. a. latirostris*, and has also a decidedly shorter wing and tail, but agrees so minutely in coloration with the female of the Guatemalan form of *P. aglaiae*, that

I am unable to detect any difference. In fact, the male also is very similar, except that the Guatemalan bird has a more or less distinct indication of a whitish or rosy patch on the lower part of the throat. It is this intermediate character of the Guatemalan bird that induces me to choose a trinomial rather than a binomial appellation for the form under consideration.

Whether the Nicaraguan type, *P. latirostris* (Bonap.), should also be referred to the same species as a local race remains to be proven; but I am inclined to believe that such disposition of it will eventually have to be made. The case of the Costa Rican form is scarcely more doubtful; but *P. homochrous* (Sci.), of Colombia, Ecuador, and Peru seems to be specifically distinct, the female always (♀) having a rufous instead of gray or blackish cap. Such an arrangement of these puzzling forms would extend the range of *P. aglaiae* from northern Mexico (and contiguous portions of Arizona) to Costa Rica, but would provide for the recognition of the following geographical or local races:

(1) *P. aglaiae* (Lafr.). Eastern Mexico. (*P. affinis* Elliot seems unquestionably to be a pure synonym of this name.)

(2) *P. aglaiae albiventris* (Lawr.) Western Mexico. (I have previously referred Yucatan specimens to this form, but I now am inclined to consider those that I have seen from that country as representing a worn and bleached plumage of *aglaiae*.)

(3) *P. aglaiae insularis* Ridgway. Tres Marias Islands.

(4) *P. aglaiae hypophæus* Ridgw. Honduras. (Grading into *aglaiae* through specimens from Guatemala and southern Mexico.)

(5) *P. aglaiae latirostris* (Bonap.). Nicaragua.

(6) *P. aglaiae obscurus* Ridgw.\* Costa Rica.

## 2. *Pithys bicolor olivascens*, subsp. nov.

SUBSP. CHAR.: Similar to *P. bicolor* Lawr., but much more olivaceous, particularly on the sides, where the feathers adjoining the white of the breast and belly are conspicuously margined with white, producing a scaled appearance.

Type No. 120197, U. S. National Museum, ♂ ad., Santa Ana, Honduras, November 20, 1890; Erich Wittkugel.

The true *P. bicolor* occupies an intermediate position between this form and *P. leucaspis* Sci., of northern South America, the three being doubtless geographical races of a single species.

## 3. *Gymnocichla chiroleuca* Sci. & Salv.

Since neither the female nor young male of this very distinct species appear to have been described, I give descriptions herewith:

*Adult female* (No. 120195, U. S. National Museum Santa Ana, Honduras, November 20, 1890; Erich Wittkugel): Top of head and hind

\* See these proceedings, page 474.

neck mummy brown; back, scapulars, and rump olive, tinged with slate-color, the upper tail-coverts inclining to raw umber; outer webs of tail-feathers plain bistre, inner webs more dusky brown; lesser wing-coverts and margin of wing deep tawny; greater coverts bistre brown, passing into black subterminally, their tips rather broadly and sharply tawny; outer surface of secondaries warm brown (between bistre and vandyke), the outer webs of primaries brighter or more russet. Lores and whole of the orbits naked, the naked space extending almost to the occiput, with the posterior extremity pointed. All the feathering below this naked space, as well as along the posterior half of its upper margin, together with chest, deep tawny, the remaining lower parts similar but paler, changing on sides to olive, and on under tail-coverts to mixed olive and tawny. Bill dusky (bluish in life?); legs and feet grayish dusky (bluish in life?), the claws light horn gray. Length (skin), 6.25; wing, 3.00; tail, 2.25; culmen, 0.83; bill from nostril, 0.50; tarsus, 1.15; middle toe, 0.78.

*Young male* (No. 120194, same locality, date, etc.): Similar to the adult female, but top of head and hind neck rather duller brown, the middle and greater wing coverts without trace of tawny, and the tawny which covers solidly the exposed surface of the lesser coverts lighter in color. Length (skin), 6.10; wing, 2.90; tail, 2.40; culmen, 0.90; bill from nostril, 0.49; tarsus, 1.15; middle toe, 0.75.

#### 4. *Grallaria guatemalensis* Prévost ?

A young male (supposed to be this species) is very different from the adult, as shown by the following description:

*Young* (No. 120198, U. S. National Museum, Santa Ana, Honduras, October 24, 1890; Erich Wittkugel): Top of head and hind neck dark slate-color, each feather marked near end with a tear-shaped streak of pale buff—the slate-color considerably darker, or approaching black, immediately about these markings; throat, chest, and breast similarly colored and marked, but slate-color rather lighter and buffy streaks longer, extending along the shafts of the feathers nearly to their base; lower breast marked with large, somewhat pandurate, spots of buff. Rest of plumage as in the adult (except wing-coverts more distinctly spotted), the feathers having been molted and those of the adult dress assumed.

On account of lacking specimens of the latter and authentic specimens of the young of the former, I am unable to determine whether this specimen should be referred to *G. guatemalensis* or to *G. princeps* Sel. and Salv., the form which replaces it in Costa Rica and Veragua.

The following species may be mentioned on account of the locality:

(1) *Spinus notatus* (Du Bus). Six specimens, Santa Ana, December 23, 1890.

(2) *Dives dives* (Bonap.). Guaruma, January 23, 1891.

(3) *Myiobius erythrurus* Cab. Santa Ana, December 22, 1890, and San Pedro Sula, January 30, 1891.

(4) *Thamnophilus melanocrissus* Scl. San Pedro Sula; five specimens, August, September, and December.

(5) *Sclerurus guatemalensis* Hartl. Four specimens; Santa Ana, November 6 and 20, and La Puente, November 12.

(6) *Sclerurus mexicanus* Scl. Volcan de Puca, April 8.

(7) *Automolus pallidigularis* Lawr. Santa Ana, October 15.

(8) *Phæochroa roberti* Salvin. San Pedro Sula, January 31; Santa Ana, October 16.

(9) *Uranomitra cyanocephala* (Less.). San Pedro Sula, November 28.

(10) *Hylomanes momotula* Licht. Santa Ana, October 9; two specimens.

(11) *Ceryle superciliosa stictoptera* Ridgw. Locality not specified, December 2.

(12) *Aulacorhamphus prasinus* (Gould). Chasniguas, January 2.

(13) *Scardafella inca* (Less.). Chamelicon, December 2-26.



## NOTES ON SOME COSTA RICAN BIRDS.

BY

ROBERT RIDGWAY,  
*Curator of the Department of Birds.*

For the privilege of examining and reporting upon a small but very interesting collection of birds from that remarkably prolific country, the author is indebted to the courtesy of the Director of the Costa Rica National Museum, Sr. Anastasio Alfaro.

With their usual liberality, the authorities of the above mentioned institution have presented all type specimens to the U. S. National Museum.

### 1. *Mimus gilvus* (Vieill.).

An adult example from El Zarcero (altitude about 7,000 feet), collected March 1, 1887, by Mr. José C. Zeledon, is apparently identical with the Colombian bird. Length (skin), 9.80; wing, 4.65; tail 4.95 (graduation, 1.30); exposed culmen, 0.78; tarsus, 1.35; middle toe, 0.90. White on inner web of outer tail feather 1.55 in extent along shaft. "Iris pale dirty yellow."

### 2. *Oreothlypis gutturalis* (Cab.).

A young female may be described as follows:

*Young female* (No. 2116, Museo Nacional de Costa Rica, Achiote, C. R., July 27, 1888; A. Alfaro): Above dull plumbeous-gray, with a triangular patch of black on the back, as in the adult; chin, throat, and chest pale dingy buff, the feathers grayish, white beneath the surface, their bases deeper grayish; rest of under parts whitish medially, grayish laterally.

### 3. *Eucometis cassini* (Lawr.).

*Young* (No. 3366, Museo Nacional de Costa Rica, Jiménez, C. R., August 10, 1889; A. Alfaro): Much duller in color than the adult, with none of the yellowish olive-green on top of the head, which is the same color as the back, with a very faint tinge of olive on the occiput; breast and sides merely tinged with olive-green, the middle line of the breast and belly being dull brownish buff, the under tail-coverts browner; forehead and lores less black than in the adult. Otherwise, the general coloration is similar to that of the adult.

4. *Platypsaris aglaiae obscurus*, subsp. nov.

SUBSP. CHAR: Adult male similar to that of *P. aglaiae hypophæus*,\* but under parts darker anteriorly, the feathers of the throat and chest still darker centrally, producing an indistinct spotted or scaled appearance; first primary with a small white spot at base of inner web; adult female similar to that of *P. aglaiae latirostris*, but smaller.

*Adult male* (type, No. 121,331, U. S. National Museum, Jiménez, Costa Rica, February 4, 1891; Alfaro & Carraura): Pileum and hind neck glossy, slightly greenish, black, becoming dull sooty blackish on anterior portion of forehead and nasal plumes; rest of upper parts dark slate-color, approaching slate-black on the interscapular region, the edges of the remiges and greater wing-coverts more grayish slate; scapulars with a considerable part of their concealed portion pure white, showing wherever the feathers are disarranged. Under parts deeper slate-gray, somewhat darker anteriorly, where, on the throat and chest, each feather has a dusky slate central spot, producing a somewhat squamated appearance. Lores dull slate-gray, but ear-coverts glossy slate-black. Upper mandible black, lower dark plumbeous; legs and feet grayish black (plumbeous in life†). Length (skin), 5.65; wing, 3.50; tail, 2.50; exposed culmen, 0.62; tarsus, 0.80; middle toe, 0.55.

*Adult female* supposed to be this species, but possibly *P. latirostris*—(No. 131332, U. S. National Museum, Jiménez, Costa Rica, March 30, 1891; Anastasio Alfaro): Pileum dull slate-black, becoming dull brownish gray anteriorly; rest of upper parts clear rufous-tawny (a little darker than in *P. latirostris*), the tips and a considerable portion of inner webs of primaries dusky. Ear-coverts, sides of neck, sides, and flanks tawny-ochraceous (paler posteriorly); rest of under parts pale tawny-buff (gradually blending into the deeper color of the lateral portions), the chin almost white. Upper mandible black; lower mandible and feet plumbeous; iris very dark brown.† Length (skin), 6.00; wing, 3.25; tail, 2.40; exposed culmen, 0.62; tarsus, 0.80; middle toe, 0.50.

I at first identified this bird as *P. homochrous* (Scl.), but upon reëxamination find that it can not be that species, if correctly described and figured. *P. homochrous*, as described, is larger (length, 7.00; wing, 3.70; tail, 3.90), and lacks the dark spotting on the throat and chest, while the female has the pileum rusty, like the back, instead of conspicuously slate-blackish.

In these "Proceedings," Vol. v. p. 397, I referred a female *Platypsaris*, collected by Mr. C. C. Nutting at La Palma, on the west coast of Costa Rica, to *P. homochrous*, though expressing strong doubts as to the correctness of the identification. I am now convinced that the specimen in question is referable to *P. latirostris* (Bonap.), specimens of which, representing both sexes, were subsequently obtained by the same

\* See these Proceedings page 467.

† MSS. memoranda on label.

gentleman on the island of Ometepe, in Lake Nicaragua.\* The La Palma specimen agrees minutely in coloration with the female from Ometepe, the only difference worth mentioning being the very slightly darker color of the pileum. In size it is somewhat less, though not so much so as the female from Jiménez, described above.

5. *Picolaptes gracilis*, Ridgw.†

A specimen (male) collected by Mr. Alfaro at Cobia de Salinas July 9, 1890 (No. 5085, Museo Nacional de Costa Rica), is much like the type of this supposed species, but has the ground color of the anterior upper parts (back included) browner, with the dusky streaks margining the pale median streaks quite obsolete on the back, these pale streaks being also more fulvous. The ground color of the under parts is also paler. The bill is exactly the same length, measured both from the nostril and from the base of the culmen, though it seems longer; but it is somewhat stouter, as well as less distinctly curved.

I have now little doubt that both these specimens are young birds of *P. compressus*, and not a distinct species.

6. *Scytalopus argentifrons*, sp. nov.

SP. CHAR: *Adult male* (No. 121329, U. S. National Museum, Volcan de Irazú, Costa Rica, April 23, 1891; Anastasio Alfaro): Forehead and anterior portion of crown silvery gray; ‡ hind neck, back, and scapulars dusky brownish slate-color; wings similar but a very little bit more brownish, the tertials having indistinct rusty terminal margins; lower back dusky brownish, changing to a more rusty brown on rump and upper tail-coverts—only the tips of the feathers thus colored, however, their entire concealed portion being uniform leaden slate-color; tail uniform dusky brownish slate, like wings. Head (except as already described) and under parts as far back as the belly, plain dull slate-color, paler, or in fact inclining to whitish, on middle of the belly and having a hoary or silvery cast about the head in certain lights; fluffy flank-feathers clear mummy brown, marked with rather broad curved bars of blackish; femoral and anal regions similar, but ground color paler (nearly cinnamon); under tail-coverts light tawny-brownish, indistinctly barred with dusky. Under surface of the wing plain dusky brownish gray, the edges of the remiges pale drab. Bill black; tarsi brownish black on outer side, light olive on inner side toes light horn-color or olive. Length (skin), 4.30; wing, 2.15; tail 1.60; exposed culmen, .45; tarsus, .80; middle toe, .68.

\*Cf. Proc. U. S. Nat. Mus., Vol. vi, pp. 393, 394.

†Proc. U. S. Nat. Mus., Vol. xi, Sept. 20, 1889, p. 542.

‡ Unfortunately the whole hinder crown and occiput have been shot away; but another specimen (sex not determined) has these parts dull brownish, the feathers slaty on the basal portion.



*Young* (No. 121330,\* Volcan de Irazú, May 1891; Anastasio Alfaro): Above dusky brown (nearly clove-brown), each feather with a more or less distinct subterminal  $\cap$ -shaped or semicircular bar of bistre or sepia brown, the rump and upper tail-coverts with more regular as well as much more distinct bars of a light tawny-brown; wings much browner than in the adult, the greater coverts and tertials with rather indistinct tawny-brown tips; chin and throat pale grayish, mixed with buff, passing laterally into uniform brownish gray on sides of neck and malar region; ear-coverts uniform slate dusky; chest dull brownish gray, the feathers of median portion indistinctly tipped with dull buffy grayish; breast and belly dusky, conspicuously squamated with buff; flanks, under tail-coverts, etc., as in the adult. Length (skin), 4.40; wing, 1.95; tail, 1.50; exposed culmen, .43; tarsus, .80; middle toe, .68.

Another adult (No. 5419, Museo Nacional de Costa Rica, same locality, etc.), is essentially like the one described, its measurements being as follows: Length ("mummied" specimen), 4.25; wing, 2.05; tail, 1.48; exposed culmen, 0.45; tarsus, 0.80; middle toe, 0.68.

The only Colombian species with which I have been able to compare this are *S. griseicollis* (four specimens) and *S. analis* Lafr. It agrees with the latter in general style of coloration and in the very long and strong hind toe and claw, but is much smaller, has a slenderer bill, with less curved outlines, and is furthermore distinguished by the silvery luster to the plumage of the head, especially on the forehead.

The discovery of a species of this Antarctic and Andean family at a locality north of the Isthmus of Panama is a notable event, for the achievement of which Mr. Alfaro deserves congratulations.

#### 7. *Chloronerpes caboti* (Malh.).†

An apparently immature male specimen differs from undoubted adults of *C. caboti* from both Costa Rica and Honduras in its generally darker and duller coloration. It may be described as follows:

*Immature male* (No. 5406, Museo Nacional de Costa Rica, Jiménez, C. R., March 28, 1891; Anastasio Alfaro): Above, plain greenish olive, brightest on the lower back, but nowhere approaching the bright tawny-olive of the adult; whole crown and occiput, superficially, red, as in the adult, but the color less bright; pale subauricular space much less distinct than in the adult; lower parts dull olive, altogether less bright and tawny or oleaginous than in the adult. "Bill black; iris dark brown; feet slate-gray." Length (skin), 6.20; wing, 3.30; tail, 1.82; culmen, .82; tarsus, .68.

#### 8. *Trogon massena* Gould.

Two adult males, one from Pacuare (No. 1591, M. N. C. R., May, 1876, J. C. Zeledon), the other from Jiménez (No. 3948, M. N. C. R., December 24, 1889, George K. Cherrie), are remarkably different in the color-

\* No. 5417, Museo Nacional de Costa Rica.

ing of the metallic portions of the plumage. The latter, which Mr. Cherrie writes is the common or prevailing type in Costa Rica, has no shade of blue anywhere, the tail and back being in fact decidedly bronzy, other portions (head, neck, chest, rump, and upper tail-coverts) being bright bronze-green. The other specimen has the green everywhere of a decided bluish cast, becoming almost blue on the rump, upper tail coverts, and hind-neck. There are apparently no other differences beyond those which may be attributed to ordinary individual variation. The two birds certainly look like distinct species, but on comparing a considerable series of specimens it is seen that they merely represent extreme variations of one bird, as the following will show:

No. 3948, Museo Nacional de Costa Rica, Jiménez, Costa Rica. Bronze-green, with back and middle rectrices bronze.

No. 3476, Museo Nacional de Costa Rica, same locality. Bronze-green, with back more bronzy.

No. 1596, Museo Nacional de Costa Rica, Naranjo, Costa Rica. Bronze-green, the back more bronzy.

No. 1591, Museo Nacional de Costa Rica, Pacuare, Costa Rica. Bluish green, becoming greenish blue on rump, upper tail-coverts, and hind neck.

No. 34875, U. S. National Museum, Turrialba, Costa Rica. Pure green, tinged with bronze on scapulars.

No. 34896, U. S. National Museum, Angostura, Costa Rica. Bronze-green, upper tail-coverts abruptly bluish green, and scapulars mixed with bronze feathers.

No. 62086, U. S. National Museum, Veragua. Bronze-green, mixed with clear green on the rump.

No. 53978, U. S. National Museum, Panama. Clear green, becoming bronze-green on scapulars and across lower back.

No. 91276, U. S. National Museum, Los Sábalos, Nicaragua. Bronze-green, mixed with bronze on back and scapulars.

No. 120251, U. S. National Museum, San Pedro Sula, Honduras. Bronze, becoming bronze-green on head, rump, and upper tail-coverts.

No. 120252, U. S. National Museum, same locality. Similar to No. 120251, but a little greener.

No. 40457, U. S. National Museum, Greytown, Nicaragua. Clear, green, more bluish on head, scapulars mixed with bronze, back tinged with bluish green, and upper tail-coverts abruptly bluish green.

No. 50550, U. S. National Museum, Guatemala. Bronze-green, more bronzy on scapulars, clear green on head, and longer upper tail-coverts.

An adult female from Pozo Azul (No. 1592, Museo Nacional de Costa Rica, December 1, 1885, J. C. Zeledon) differs remarkably from all others I have seen in having the entire bill black, the under mandible quite as uniform and deep black as the upper, instead of orange or orange-red (drying dull yellowish). An immature female (No. 43009, U. S. National

Museum, San Mateo, April, 1866, J. Cooper) has the lower mandible dusky brown, but showing a lightening of color at the tip and base.

A young male in transition plumage (No. 3476, Museo Nacional de Costa Rica, Jiménez, August 18, 1883, A. Alfaro) may be described as follows: Pileum bright metallic grass-green; hind neck, back, and scapulars metallic olive-green or bronze; rump and upper tail coverts metallic grass-green; six middle tail feathers bronzy purplish black, their outer webs edged with bronze-green, this occupying nearly the entire outer web of the middle pair of rectrices, the inner webs of which have a copper-bronze luster in the proper light; three outermost pairs of rectrices black, tipped (for about .25-.30 of an inch) with white, and narrowly barred with white along the edge of the outer web (entirely across near the white terminal spot, and much more distinct, as well as extending much farther toward the base on the outermost feather). Secondaries dull slate-black, margined and irregularly barred with dull light buff. Breast and anterior portion of sides light ash-gray barred or undulated with darker. Upper mandible blackish, with basal half of cutting-edge orange.

#### 9. *Trogon aurantiiventris* Gould.

A male from the Volcan de Irazú (No. 5529, Museo Nacional de Costa Rica, May 21, 1891) and a female from Cartago (No. 5528, May 30, 1891) differ from all the specimens of *T. aurantiiventris* in the U. S. National Museum collection in the color of the under parts, which in the male is pure orange and in the female a pale orange, instead of saturated, reddish orange, or salmon-color. I am not able to detect any other differences, however.

#### 10. *Accipiter subniger* (Vieill.).

= "*A. tinnus* (Lath.)," and "*A. superciliosus* (Linn.)."

An adult male from Greytown, Nicaragua (No. 5115, Museo Nacional de Costa Rica, June 15, 1890, Anastasio Alfaro), measures as follows: Length (skin), 8.50; wing, 5.15; tail, 3.90; culmen, 0.42; tarsus, 1.58 (unfeathered portion, 1.08); middle toe, 1.05. "Iris, crimson; bill, black; feet, cadmium yellow; soles of toes, Indian yellow." Four black bands on tail.

## NOTE ON *PACHYRHAMPHUS ALBINUCHA*, BURMEISTER.

BY

ROBERT RIDGWAY,

*Curator of the Department of Birds.*

For some 17 years there has been in the collection of the U. S. National Museum, a bird-skin labeled with the above name, received from Dr. Burmeister himself. This name I have been unable to find in any work where it would be expected to occur, even the "Argentine Ornithology" of Messrs. Scater and Hudson mentioning it but casually in the bibliographical appendix, while Dr. Scater's catalogue of the Oligomyodæ ("Catalogue of the Birds in the British Museum," vol. xrv) absolutely ignores it. This seems very remarkable in view of the fact that the bird was clearly described as long ago as 23 years (P. Z. S., 1868, p. 635), and is so conspicuously distinct from anything else, though resembling superficially in coloration *Pachyrhamphus cinereus* (Bodd.).

*Pachyrhamphus albinucha*, having a pycnaspidian tarsus, is a member of the family *Cotingidæ*; but it is so different in other points of its structure from the typical members of the genus in which it was placed by its describer that there can be no question it does not belong there. In fact, the normal size and form of the second primary necessitates its removal from the subfamily *Tityrinæ*. According to the characters used by Dr. Scater for the classification of these birds, it would seem to belong to the subfamily *Lipauginæ*; but on comparison with the various genera in this and other "subfamilies" it is found to approach more nearly to *Casiornis* in structure than to any other. The differences, however, from *Casiornis*, are so numerous and so great, that there seems to be no resource but to establish a new genus for its reception. I, therefore, propose as the name for the new genus the name *Xenopsaris*.

The characters of the genus and its type species are as follows:

*Xenopsaris*, genus novum Cotingidarum. (Type, *Pachyrhamphus albinucha* Burmeister.)

GEN. CHAR.: Similar to *Casiornis* Bp., but bill very much smaller, narrower, and more elevated at the base, with culmen gradually curved throughout its length; nasal and rictal bristles much less developed; tail nearly as long as the wing, emarginate and rounded (i. e., double-rounded), the feathers rather narrow; primaries exceeding secondaries by more than length of bill; the second, third, and fourth quills nearly

equal, and longest; first primary equal to sixth; tarsus about equal to length of bill measured from the rictus; middle toe considerably shorter than tarsus (slightly less than exposed culmen); feathers of pileum lengthened and broad, forming when erected a full, rounded crest; along each side of the lower back and rump a conspicuous tuft of pure white cottony feathers. Color (both sexes) grayish above, with glossy black, full-crested pileum, the lower parts, sides of head (below eyes), nuchal collar, lores, and frontlet, white.

*Xenopsaris albinucha* (BURM.).

*Pachyrhampus albinucha* BURM., P. Z. S., 1868, 635.

SP. CHAR.: *Adult* (No. 67388, U. S. National Museum, Rio de la Plata, Buenos Ayres; Dr. H. Burmeister): Entire pileum (except narrow frontal band), down to the middle of the eyes, glossy black, with a slight bluish luster; narrow frontal band (including nasal tufts), lores, suborbital region, ear-coverts, and entire under portion of head, neck, and body, white; a rather narrow grayish white nuchal collar (immediately below the black pileum); hind neck and back uniform ash-gray, the secondaries and rump similar but browner; wings, tail, and upper tail-coverts grayish brown, the wing-coverts narrowly and indistinctly margined with whitish, the tertials distinctly edged with white; tail darker than wings, especially towards the end, the shafts pale brown basally; outer tail-feather broadly edged and margined round end with white. Upper mandible, black; lower, grayish (plumbeous in life!); feet dusky in dried skin. Length (skin), 4.90; wing, 2.45; tail, 2.30; exposed culmen, 0.38; tarsus, about 0.48; \* middle toe, about 0.35.

To his excellent description, cited above, Dr. Burmeister adds the following:

This small bird lives in the sedge of the shores of the Rio de la Plata, near Buenos Ayres, and has a somewhat melancholy temperament, sitting quite still in the same place a long time. Both sexes are alike in color, but the color of the male is much clearer, and the white nuchal band broader and more distinct.

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\* Feet considerably mutilated, so that exact measurements can not be taken.

DESCRIPTION OF TWO SUPPOSED NEW FORMS OF THAM-  
NOPHILUS.

BY

ROBERT RIDGWAY,  
*Curator of the Department of Birds.*

1. *Thamnophilus albicristus*, sp. nov.

SP. CHAR.: Resembling *T. major*, Vieill., but remiges entirely without white edgings, white bars on tail much smaller, black beneath eyes much broader, and bill much stouter.

HABITAT: Trinidad? (Type, No. 85497, U. S. National Museum; from Southwick and Jencks.)

This is evidently a very distinct bird from *T. major*, and is represented in the collection by an adult male and two females, of uncertain locality, but all of the same "make," which conforms exactly to that of skins from Trinidad. The male is not quite in perfect plumage, the greater wing coverts, though deep black in color, being narrowly tipped with light fulvous. In the adult male of *T. major* these feathers are not only broadly tipped with pure white, but this color follows the edge of the feathers a considerable distance.

From *T. melanurus* Gould, which I have not seen, this species seems to differ in the spotted tail and smaller size, the wing especially being considerably shorter (3.40 instead of 3.80 inches).

2. *Thamnophilus trinitatis*, sp. nov.

SP. CHAR.: Most like *T. cirrhatus* (Gmel.), but back much deeper and darker brown, black of under parts much more extensive, sides and flanks much darker gray, and white edgings to rectrices much less distinct.

HABITAT: Island of Trinidad. (Type, No. 32848, U. S. National Museum, Trinidad; Verreaux.)

In the color of the back this bird resembles *T. pulchellus*, Cab. and Heine, much more closely than *T. cirrhatus*, but the color is even a darker brown, which, however, does not extend over the rump as it does in *T. pulchellus*. It lacks the brown of the sides and flanks as well as the white head-markings, in these respects agreeing with *T. pulchellus*.



DESCRIPTION OF A NEW SHARP-TAILED SPARROW FROM CALIFORNIA.

BY

ROBERT RIDGWAY,

*Curator of the Department of Birds.*

*Ammodramus caudacutus becki*, subsp. nov.

**SUBSP. CHAB:** Similar to *A. caudacutus nelsoni*, but bill very much more slender, back more heavily marked with black, buff of anterior and lateral under parts more creamy, and chest less distinctly streaked.

**Adult** (No. 120310, Milpitas, Santa Clara County, California, May 6, 1891; Rollo H. Beck): Pileum deep bistre-brown, darker, or mixed with blackish laterally, and divided longitudinally by a rather broad though indistinct dusky grayish median stripe; hind neck mixed tawny-brown and light grayish; interscapulars black, mixed with tawny olive-brown (the last predominating along the median line of the back), the feathers, especially those toward the scapulars, broadly edged with grayish white, tinged, especially on middle of back, with buffy; scapulars dull tawny-brown, each with a central or median elongated spot of blackish; greater wing-coverts with outer surface mainly tawny-brown, paler at tips, the subterminal portion with a dusky, ill-defined, mostly concealed, spot; tertials black centrally, margined (broadly on outer webs) with tawny-brown, fading to whitish on outer web of first and terminal portion of outer web of second feather. Lower back and rump light grayish tawny or isabella-color, rather indistinctly streaked with dusky; upper tail-coverts similar but more buffy, with dusky streaks more distinct. Tail-feathers light grayish brown, edged with a more buffy hue (the two outermost with pale buffy grayish), and marked with a median streak of dusky. Sides of head, including a broad superciliary stripe, tawny-ochraceous, interrupted by a grayish olive auricular patch; sides of neck, immediately behind the latter with a small blackish blotch. Chin, throat, chest, sides, flanks, and under tail-coverts buff, deepest on chest, which, with sides and flanks, are streaked with brownish black, the streaks less distinct on chest; breast and belly plain white. Bill grayish horn color (bluish in life ?), with upper mandible mainly blackish; legs and feet light horn color. Length (skin), 4.55; wing, 2.15; tail, 1.90; exposed culmen, 0.38; depth of bill at base, 0.20; tarsus, 0.78; middle toe, 0.58.

In the very slender bill, the large amount of black on the back, and



coloration of the sides of the head and lower parts, this new form resembles *A. leconteii* more closely than *A. caudacutus nelsoni*. The lower parts are, in fact, exactly the same, while as to the sides of the head the only difference is that *A. leconteii* has pale grayish instead of deep buff lores, and a more distinct blackish post-ocular streak. In other respects, however, it is very different from *A. leconteii*, the absence of a sharply defined median crown-stripe and the presence of conspicuous whitish streaks on the back being the most obvious characters.

The single specimen upon which this new form is based was shot by Mr. Beck (after whom I have the pleasure of naming it), "among the tules on the edge of a small salt-water slough leading into the southern extremity of San Francisco Bay in Santa Clara County."

NOTES ON *SCELOPORUS VARIABILIS* AND ITS GEOGRAPHICAL  
DISTRIBUTION IN THE UNITED STATES.

BY

LEONHARD STEJNEGER,

*Curator, Department of Reptiles and Batrachians.*

Hallowell's *Sceloporus marmoratus* has had a very curious fate in our herpetological literature. The name occurs a few times in later nominal lists, but so little is known of it, and so little has been said of it that Boulenger, in the second volume of the Catalogue of Lizards in the British Museum, was compelled to simply refer to it in a foot-note (p. 216).

Two specimens of Fence-Lizards brought home by Dr. S. W. Woodhouse from San Antonio, Bexar County, Texas, were described in 1852 by Hallowell as *Sceloporus marmoratus* and *S. delicatissimus* (Proc. Phila. Acad., VI, p. 178), and fuller details, as well as two wretched plates illustrating the two supposed species, were given in Captain Sitgreaves' Report of an Expedition down the Zuñi and Colorado Rivers (pp. 109, 110). The alleged differences of these consisted chiefly in the somewhat different number and arrangement of the cephalic scales. It must have been plain, however, to anybody familiar with the great variability of these scales in this group of lizards that the two species were only individual variations of the same thing, and in Professor Baird's report upon the reptiles collected during the survey of the United States and Mexican boundary the two forms were correctly united, the name *marmoratus* being retained as the first one described by Hallowell (p. 6). In this report two additional localities for the species were recorded, both in southwestern Texas.

We next find the name *S. marmoratus* in Cope's Check-list of North American Batrachia and Reptilia (1875), but with an entirely different habitat, as, on page 48, it is referred to the "Sonoran region, Utah," and on page 92 it is enumerated as one of the "species confined to the Sonoran region." This exclusion of *S. marmoratus* from the original habitat is still more accentuated five years later, as it is not at all mentioned in Professor Cope's memoir "On the Zoological Position of Texas." This misplacement seems not to have been caused by the accession of new material, but is probably due to a *lapsus* of some kind, for, as will be shown further on, this form seems really to be confined to southwestern Texas so far as its occurrence within the United States

is concerned. Garman (List of N. A. Rept. and Batr., 1884, p. 17) shifts the locality still further west by assigning *S. marmoratus* to "Southern California."

The only other American author referring to it under the name of *S. marmoratus* is Yarrow, who, in his Check-list of North American Reptilia and Batrachia (p. 58, 1883), refers to it two specimens, one (No. 4116) from "Redmond's Ranch, Rio Grande," the same mentioned by Professor Baird (*loc. cit.*), and another (No. 2885) from "San Diego, California." The latter specimen is correctly identified, but the statement as to the locality involves a double error, for, in the first place, the original No. 2885 did not come from San Diego, California, but from San Diego, Nuevo Leon, Mexico, and in the second place this specimen is not at all No. 2885, but a much more valuable one, as attested by the original parchment label which is still firmly attached to it, for it is nothing less than the type specimen of Hallowell's *Sceloporus delicatissimus*, which was thought to have been lost.

It was the examination of this specimen that proved to me conclusively that *S. marmoratus* is nothing but a synonym of *Sceloporus variabilis* of Wiegmann.

The latter name has but recently been introduced in the herpetological works as occurring within the United States. Boulenger in the third volume of the Catalogue of Lizards in the British Museum (1887, p. 503) mentions three specimens from "Duval County, Texas," collected by W. Taylor, Esq., and Cope, about simultaneously (Proc. U. S. Nat. Mus., 1888, p. 397), records nine specimens as belonging to the National Museum from the same source.\* He adds: "First found in the United States near Corpus Christi, by Francis Aaron," but as *S. marmoratus* is the same as *variabilis* the species was found within the United States long before it was collected by Mr. Aaron.

The identification of *S. marmoratus* with *variabilis* extends the known range of the latter considerably, as San Antonio, whence came the type, is situated about 120 miles north of San Diego and Corpus Christi. The species does not seem to be rare even so far north, for we have, in addition to the type of *S. delicatissimus*, another specimen, a female from Medina, the county on the southwest of Bexar, as well as a female collected by Mr. G. W. Marnock at Helotes, in the latter county. Both of these specimens I found labeled "*Sceloporus scalaris*" (and the first one is so recorded by Yarrow, Bull. U. S. Nat. Mus., No. 24, p. 62), with which species there is no good reason for confounding them. However, Professor Cope (Zool. Pos. Texas, p. 17) states that *S. scalaris* "is abundant in the region southwest of San Antonio, according to Mr. Marnock, from whom I obtained specimens," and it may therefore be that both species occur there, though our Museum possesses no specimen of true

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\* Of these I have been unable to find more than two specimens in the collections of the Museum, and only these are, therefore, included in the list of specimens examined given below.

*Sceloporus scalaris* from the region in question. On the other hand, Professor Cope records "seven specimens" received from San Diego, Texas, as "*Sceloporus ? scalaris*" (Proc. U. S. Nat. Mus., 1888, p. 397) as if he was uncertain as to their belonging to this species, an uncertainty which I am inclined to extend to all the alleged specimens of *S. scalaris* from southwestern Texas. That I am unable to express any final opinion upon the San Diego specimens is due to the fact that the specimens, although stated to belong to the Museum, have not been found in spite of an extended search.

There are two more Texan specimens in the collection, viz, No. 11457, collected by Mr. George B. Sennett in "Texas," presumably somewhere on the lower Rio Grande between the mouth and Hidalgo where Mr. Sennett was collecting during April and May, 1877. The other specimen is No. 4116, from "Redmond's Ranch" on the Rio Grande, the same as Bellville, about 70 miles below Laredo.

There remains one specimen which requires special mention on account of the uncertainty of its origin. It has a tin tag attached to it numbered 2882, which, if correct, would give it "China, Nuevo Leon, Mexico" for a locality, and Lieutenant Couch for a collector, but to one of its legs is tied an original parchment label which reads, "4108, Utah, December," and the record book gives the information that it was "removed from No. 2877," a bottle containing numerous specimens of *Sc. graciosus* collected at Salt Lake, Utah, by Captain Stansbury. Several other "removals" took place at the same time, however, and it is almost certain that both numbers are wrong. At any rate it would not do to credit Utah with *S. variabilis* on the strength of the present specimen.

In order to facilitate the identification of this species, which has been so singularly overlooked within our territory, I may point out some of the most salient characters by which it may be recognized.

*Sceloporus variabilis* differs from all the species hitherto found within the United States by having the scales of the sides of the body considerably smaller than those of the back; a white half-moon-shaped mark on the side above the insertion of the fore limb is present in both sexes and is quite characteristic. The male, moreover, is readily distinguished by the flank patches of a pink (in alcohol grayish) color, which come very close together on the belly and are bordered by a dark bluish line, the latter joining a large dark patch on the shoulder behind the white semilunar mark. Among the other characters the following may be mentioned: Head-shields wrinkled; lateral scales directed obliquely upwards; femoral pores about twelve on each side, not meeting medially across the belly; about fifteen dorsal scales in a head length; anterior frontal divided longitudinally.

*Sc. scalaris*, on the other hand, is easily distinguished by having the series of femoral pores nearly meet across the belly; the scales on the sides are nearly as large as those of the back, and these are much larger

than in *Sc. variabilis*, about eight corresponding to the length of the head; no white semilune on shoulder, and male with "deep-blue" flank patches; anterior frontal undivided.

*List of specimens examined.*

U. S. Mus. No.	No. of spec.	Sex and age.	Locality.	By whom collected.	From whom received.	Remarks.
16020	1	♂ ad	San Antonio, Tex .....	Dr. S. W. Wood- house.	.....	Type of <i>S. deli-</i> <i>catissimus</i> .
2916	1	♀ ad	Medina, Tex. ....	T. D. Cutts .....	.....	.....
4118	1	♀ ad	Redmond's Ranch, Rio Grande	J. H. Clark .....	Major Emory	.....
11467	1	♀ ad	"Texas" .....	G. B. Sennett .....	.....	.....
13630	1	♀ ad	Helotes, Tex .....	G. W. Marnock .....	.....	.....
15654	1	♂ ad	San Diego, Tex .....	W. Taylor .....	.....	.....
15655	1	♂ ad	do .....	do .....	.....	.....
4108	1	♀ ad	(?) .....	(?) .....	.....	.....
2886	1	♂ ad	Matamoros, Tamaulipas .....	Lieut. Couch .....	.....	.....
4790	2	♂ ad	Xalapa, Mexico .....	De Oca .....	.....	.....

NOTES ON JAPANESE BIRDS CONTAINED IN THE SCIENCE COLLEGE MUSEUM, IMPERIAL UNIVERSITY, TOKYO, JAPAN.

BY

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Some time ago the Educational Museum of Tokyo was abolished and the collections turned over to the Science College of the Imperial University. Dr. I. Ijima, professor of embryology and comparative anatomy, volunteered to take care of the ornithological material, and made me the proposition to send the entire collection over in installments for identification and study. I gladly accepted the offer, and avail myself of the present opportunity to publicly express my gratitude for the kindness of Dr. Ijima and the authorities of the Science College.

The following notes are the result of an examination of the first installment, and contains, as will be seen, quite a number of interesting additions to the Japanese avifauna.

The collection sent contained a number of additional specimens, but as they added nothing to our knowledge reference to them was considered superfluous.

The numbers in parenthesis preceding the names are those of Blakiston and Pryer's "Birds of Japan."

(62) *Sterna sinensis* GM.

Two specimens (Nos. 1363 and 1364), both from Hitachi, probably collected with the following. One is a young bird with dusky bill and feet, the other (1363) an adult in full plumage.

*Sterna dougalli* MONTAG.

The claim of this species to a place in the Japanese fauna rests upon a single specimen in the Pryer collection from the Liukiu Islands (Seeböhm, Ibis, 1887, p. 181). It is, therefore, interesting to find a specimen from Hitachi in the Science College collection (No. 1362). It is just completing the black hood and is in splendid condition, except that the collector has cut off the wings and sewed on those of a *Sterna sinensis*, a combination which at first staggered me, as the job was very neatly done! The bill of this specimen is red, with dusky tips, and not nearly as thick as in Seeböhm's figure (B. Jap. Emp., p. 296).

(63) *Sterna camtschatica* PALL.

Records of this species from Japan are not numerous. The present collection contains three specimens, one adult (471) from Nanaura, Boshu, province of Awa, and two young (472 and 478), the former from the same locality, October 9, 1883, the latter from the province of Shimosa, November 1, 1883. These are identical with Kamtschatkan specimens in corresponding plumage, though the tarsus is somewhat shorter. The U. S. National Museum possesses a fine adult male (No. 85783), collected by Mr. Jouy on May 9, 1881, at Tomiyoka Point, near Yokohama.

*Sterna bergii* LICHT., subsp.?

No. 1180 is another male of this form obtained October, 1889, by Mr. Nishi in the Yayeyama Islands. It is somewhat smaller than the first specimen described by me (Proc. U. S. Nat. Mus., 1887, p. 393), but apparently otherwise similar.

The question raised (*loc. cit.*) as to the correct subspecific name of this form has not been answered as yet.

(83) *Puffinus tenuirostris* (TEMM.).

A specimen collected by Mr. Ota in the province of Owari, Hondo (No. "BB"), deserves to be mentioned in addition to the other Japanese specimens already on record.

*Estrelata leucoptera* (GOULD).

In regard to this interesting addition to the Japanese fauna Dr. Ijima writes me that it was caught in the province of Mino, after a storm, in 1885.

This is the species often referred to as *Æ. desolata* (GM.), but although it is Kuhl's *Procellaria desolata* it is not the bird so named by Gmelin, which is *Halibana desolata*. It is referred to as doubtfully occurring in Kamtschatka in my List of the Birds of Kamtschatka (Res. Orn., Expl. Kamtsch. Command. Ills. 1885, p. 316).

*Æ. leucoptera* is a smaller species, but otherwise much like Salvin's *Æ. phaeopyga*.

*Bulweria bulweri* (JARD. & SELBY).

A specimen of this species, which has only recently been found in the Pacific (Pr. U. S. Nat. Mus., 1890, p. 380), was captured at Nikko, as Dr. Ijima writes, probably driven inland by a storm. He adds: "I have another very bad specimen which was picked up on the shore of Sulphur Island." Mr. Holst, who collected for Mr. Seeböhm, found it very common on Sulphur Island, where it may possibly breed (Ibis, 1891, p. 192).

*Glareola orientalis* LEACH.

Specimen No. 1166, ♀, collected by Dr. Ijima in the province of Hitachi, adds not only a new species but a whole family to the Japanese

avifauna. Total length and stretch of wing as measured by Dr. Ijima were 210 and 540 millimetres respectively.

Further account of the capture would be highly interesting, especially whether it was found alone or in company with others of the same species.

(104½) *Tringa canutus* L.

No. 306, a young bird, is from Tokio, without further information.

*Tringa ferruginea* BRÜNN.

From the fact that this species (also known as *T. subarquata*) has been recorded from the Tchukchi peninsula, it was to be expected that it would turn up, occasionally at least, in Japan during the migrations, though, on the other hand, the circumstance that it had hitherto not been observed, neither in Kamtschatka nor in Japan, makes it safe to conclude that its regular migration route does not lie so far east.

Two specimens (Nos. 298 and 293), both from Giotoku, prove that it occurs both on the spring migration and in the autumn, and from the superficial resemblance to *T. alpina pacifica* (*T. cinclus*) it is probably often mistaken for the latter. The first one is a fine adult male in splendid summer plumage, collected May 23, 1884; the other is a young bird in the first fall plumage, obtained September 20, 1883.

*T. ferruginea* is easily distinguished from *T. alpina* by the bill being much narrower at the tip, by the white upper tail-coverts, and, in the summer plumage, by having the under surface rusty or chestnut, while in *T. alpina* these parts in summer are white with a large patch of blackish on the belly.

(108) *Tringa acuminata* (HORSF.).

No. 291, ♂ ad., collected at Horiye, province of Musashi, Hondo, July 27, 1883, is particularly interesting inasmuch as it is in full breeding plumage considerably abraded. In this plumage, the first I have ever seen, the bird looks very different from the winter plumage in which it is usually found. The under parts are much more densely spotted, and the yellow tinge of the fore neck is more ochraceous, while the broad rusty edges of the feathers on the upper parts are nearly gone.

The breeding grounds of this species have not yet been ascertained with certainty,\* and although the occurrence of this bird in the plumage here described in Japan on July 27 would seem to indicate that it may breed there, at least occasionally, yet it is well known that non-breeding individuals of many waders remain during summer in a much more southern latitude than the regular breeding grounds.

Seebohm (Distr. Charadr., p. 442) refers Latham's *Tringa aurita* to the present species without even a query, but Latham's description

\* See Palmén, Vega Exp. Vet. Iakt., v, 1887, p. 322.



does in no particular fit *T. acuminata*, and the name may safely be dropped from the synonymy.

(109) *Limicola platyrincha* (TEMN.).

Two specimens, Nos. 271 and 274, ♂ and ♀, were collected in 1883 at Giotoku. They agree in every respect with the specimen now in the U. S. National Museum (95955) collected by Captain Blakiston at Hakodate, in August.

(110) *Calidris arenaria* (L.).

A ♀ specimen (No. 290), from Shimosa, purchased in the flesh February, 1889, deserves mention, as the Sanderling is a comparatively rare bird in Japan.

(111) *Pavoncella pugnax* (L.).

The Ruff is sufficiently rare in Japan to justify the record here of a specimen ("CC") belonging to Mr. Ota, which was collected in the province of Owari, Hondo. Two others were also sent, belonging to the Science College Museum, viz, Nos. 332 and 333, both males, collected on October 13, the former an adult in winter plumage, at Horiye, province of Musashi, the latter a bird of the year, at Giotoku, province of Shimosa, Hondo. The last mentioned two specimens are referred to by Seebohm (*Ibis*, 1885, p. 364).

(112) *Phalaropus lobatus* (L.).

One specimen ("B"), adult, was shot by Mr. Kanai, on the shore of Lake Suwa, province of Shinano, May 17, 1889, out of a flock of sixteen. The other (No. 1358) is a young female, obtained from Mr. F. Sakamoto, in the flesh, September 27, 1890, from the province of Shimosa.

(113) *Crymophilus fulicarius* (L.).

"It has not yet been recorded from Japan proper." Specimen "DD," a winter adult, belonging to Mr. Ota, deserves therefore special mention, it having been collected in the province of Owari, Hondo.

*Phaethon rubricauda* BODD.

The only record of this species on Japanese territory is the bunch of tail feathers from Bonin, in the Tokyo Museum, and the birds seen by Holst on the island San Alessandro, 40 miles north of Sulphur Island (Seebohm, *Ibis*, 1891, p. 192). I have now before me a young specimen (Science Coll. Mus. No. 481) "captured after a storm, in 1885, in the province of Mino."

Tropic Birds can not be scarce in the seas about Japan. In Beechy's voyage of the "Blossom" it is stated (I, p. 236) that "the tropic birds accompanied us as far as 36° N.," and v. Martens (*Preuss. Exp. Ost-As.*, Zool., I, p. 59) speaks of seeing them on September 10, in latitude 31°.

*Phaëthon candidus* (DRAP.).

Another addition to the fauna. A young specimen of this species (also known as *Ph. flavirostris*) is in Mr. Ota's collection (No. "AA"), and was collected in the province of Kaga, on the Sea of Japan.

In the handbooks the three species of this genus are distinguished by characters somewhat difficult to grasp and apply. I have found a set of characters easy to recognize, by which the three species can be distinguished without the slightest difficulty in all their plumages, as follows:

- a<sup>1</sup>. Outer web of outer primaries white. .... *Ph. rubricauda*.  
 a<sup>2</sup>. Outer web of outer primaries black.  
     b<sup>1</sup>. Outer primary coverts white ..... *Ph. candidus*.  
     b<sup>2</sup>. Outer primary coverts black. .... *Ph. æthereus*.

*Ardea purpurea* L.

In my review of the Japanese Herodii (Proc. U. S. Nat. Mus., 1887 pp. 310, 311), I gave the characters of the present bird, "there being a probability that the Purple Heron may occasionally occur in Japanese territory." I am now gratified by having before me a fine adult male, collected by Mr. Nishi on the Yayeyama Island, April, 1889.

A careful comparison of this specimen (Sc. Coll. Mus. No. 1169) with the material discussed in the above mentioned paper only corroborates the distinction there pointed out between the eastern and the western birds in so far as the Yayeyama bird has the median series of black spots on the fore-neck but slightly developed; at the same time the abdomen and under tail-coverts are as black as in the Pegu bird. As for size it compares well with the largest of the European birds. The differences may turn out to be of some consequence, but the material is entirely too scanty to even allow the expression of a preliminary opinion. The Japanese individual presents the peculiarity of the median stripe on the upper hind neck being brown, not black.

Dr. Ijima writes me as follows:

Another specimen in our collection is much grayer above and darker below, there being less brown. Mr. Nishi tells me that it is abundant on Yayeyama Island.

In the paper referred to I characterized the genus *Ardea* as having the "naked portion of tibia longer than inner toe, without claw." This is certainly not the case in the present species and the synopsis (*op. cit.* p. 287) will have to be remodeled.\*

(165) *Cuculus kelungensis* SWINH.

Four adults and one young bird from various places in Hondo.

Our knowledge of the eastern cuckoos is as yet only very imperfect,

\* Mr. J. H. Gurney, jr., writes to Mr. R. Ridgway that among his father's Peregrine Falcons he found two specimens from the Kurile Islands, which are young birds and very dark all over, especially on the breast, belly, and under the wings. "They are far the darkest we have, and are evidently your *Falco pealei*." This is a very interesting addition to the fauna.

and I am sorry to say that Mr. Seebohm's treatment of the three forms known to occur in Japan (B. Jap. Emp., pp. 169-171) has only added to the confusion.

In the first place he says of Japanese examples of *C. canorus* (which I consider subspecifically distinct from the European Common Cuckoo under the name of *C. telephonus*) that they completely intergrade with the "Himalayan Cuckoo" (*C. kelungensis*) in size, and that it is not known that they differ in any way in color, except that in the adult Common Cuckoo there is no tendency for the tail to darken near the tip, and in the rufous stage there are no bars across the rump. The "Himalayan Cuckoo" again, he states to be "a small form of the Common Cuckoo, but having a totally different note it is regarded as specifically distinct. The tail has a slight tendency to darken towards the tip, and in the rufous stage the rump is barred." Now, as a matter of fact, these statements, in so far as they refer to the similarities of the two forms, do not hold good. The size of the two do not only intergrade, but they are practically alike in size. It is in color, however, that the difference is marked. It is so far from that "it is not known that they differ in any way in color," that they are known to differ in the following points:

(1) Upper surface in *C. kelungensis* (Japanese specimens) are darker and more plumbeous (bluish); (2) ground color of under surface is always more buffy, particularly the under tail-coverts; (3) dark cross-bars underneath are very much blacker, broader, and more distant than in the Japanese form of the Common Cuckoo; (4) the markings on the under wing-coverts are essentially different, the greater part of the lining of the wing in *C. kelungensis* being nearly uniform, against very narrowly and distinctly cross-barred in *C. telephonus*.

On the whole, there should be no difficulty in distinguishing these two forms, though in forms so alike superficially it may require a careful study and a large material to first point out the differences. I am inclined to think that the statements of Mr. Seebohm here criticised are due to the fact that he has not properly separated the two forms. A proof of this is before me consisting of the two skins (Blak. Nos. 2710 and 2711), which in 1884 (Ibis, 1884, p. 36) Mr. Seebohm referred to "*Cuculus himalayanus*," though in reality only No. 2710 belongs to the species he so designates (*C. kelungensis*), while No. 2711 is a specimen of the "Common Cuckoo" (*C. telephonus*).

(164) *Cuculus tamsuicus* SWINH.

An adult male (No. 1117) is from the Yagurasawa village, province of Sagami.

This species looks almost like a miniature *C. kelungensis*, but differs, besides in size, also in the coloration of the upper surface, which is more olive-gray, while in the large species it is plumbeous and darker.

The name adopted by me for the smallest of the Japan cuckoos is

possibly only a temporary one, but it is the only appellation which at present I know to be pertinent. Whether the Indian bird usually called *C. poliocephalus* really is identical with the Japanese one is a question I am not prepared to answer for want of material for comparison, but I do know that Latham's description is entirely inapplicable to the present bird,\* and that the name given by him consequently must be rejected according to all accepted rules of nomenclature.

*Halcyon pileata* (Bodd.).

Dr. Ijima writes me that the Science College Museum has recently obtained, through Mr. Ota, a specimen of this beautiful kingfisher captured in the province of Suruga, a most interesting addition to the fauna. He adds that in the old Japanese manuscripts on ornithology he finds the "description of a kingfisher larger than the common species, but resembling it and very beautiful, and said to be common in the valleys of the provinces of Hiuga and Bingo, though not found north of Hakone." He has no doubt that *H. pileata* is meant and not *H. coromanda*, as the latter is also described.

(167) *Dryobates japonicus* (SEEB.).

No. 1089 is a young male, from the province of Suruga, Hondo, a little older than U. S. Nat. Mus. No. 88704 (the young female described by me in Proc. U. S. Nat. Mus., 1886, p. 112), which it resembles very closely except that the whole crown has the feathers broadly tipped with scarlet, the black patch on the sides of neck in continuation of the malar stripe is larger and more solid black, and the spots and bars on the sides of breast and flanks less pronounced.

(172) *Picus canus jessoensis* STEJN.

No. 1438, locality unknown, is a very young specimen in the first plumage. It is similar to the adult female, but with the top of head and upper neck duller, and the light markings on wings and tail larger and more pronounced; underside from breast backwards strongly cross-marked with dusky.

(230½) *Motacilla flava leucostriata* (HOM.).

A young specimen (No. 1378) was collected by Mr. Tsuchida at Dokanyama, near Tokyo, on November 3, 1890. It is the first occurrence of this species in any of the islands of Japan proper.

(263½) *Turdus hortulorum* SCL.

By an examination of the specimen in the Museum of the Academy of Natural Sciences in Philadelphia, as well as the original records in the U. S. National Museum of the specimens brought home by the

\* "Tail almost even at the end; white, crossed with equidistant dusky bars; legs pale brown." (Suppl., I, p. 102.)

"Perry Expedition to Japan," I feel convinced that the specimen referred to by Mr. Seebohm (P. Z. S., 1879, p. 805; B. & P., Tr. As. Soc. Jap., x, 1882, p. 166) did not come from Japan.

The species will have to be retained, however, in the Japanese fauna on the strength of a specimen in the Science College Museum (No. 1365), which was collected in the province of Kaga, Hondo. It is a fully adult female (not sexed on label) in very good condition.

The brackets inclosing the reference to the present species in my synopsis of the Japanese species of the genus *Turdus* (Proc. U. S. Nat. Mus., 1887, p. 4) can now be removed.

(235) *Cisticola brunniceps* (T. & S.).

A winter specimen from Nagoya, Hondo (No. "D"), bears out fully what I have already remarked about this species (Pr. U. S. Nat. Mus., 1887, p. 407). I have found the wing of a remarkably uniform size in all the Japanese specimens measured by me, and the present one makes no exception: wing 55 millimetres, tail feathers 54 millimetres.

*Emberiza leucocephala* GM.

Mr. Nozawa has added one of the most interesting novelties to the Japanese avifauna by collecting a splendid pair of this fine bird, which were shot out of a small flock at Sapporo, Yezo, on January 30, 1890. The ♀ is No 1188 of the Science College Museum; the ♂ is designated as No. "A."

The present species, which occurs all through Siberia, has no yellow anywhere, and, like *E. rustica*, has the rump cinnamon-rufous without black streaks, being easily distinguished, however, in all plumages by its large size (wing more than 85 millimetres); the male is a very striking looking bird, with the fore-neck and eye-region beautiful chestnut and the cheeks silky white.

*Emberiza pusilla* PALL.

This addition is to be credited to Mr. Ota, who, in his collection, has a specimen collected at Nagoya, Owari, Hondo. It is marked "F," but the label contains no other information. Further details regarding the capture of this interesting specimen are desirable. The bird is a young male, or an adult female, in spring plumage.

This is another Siberian species. As the name implies, it is very small (wing of present specimen 67 millimetres). The rump is dark clay colored, somewhat streaked with dark brown; the upper lesser wing-coverts are edged with drab; culmen straight; no yellow anywhere.

(277) *Emberiza yessoensis* SWINH.

There are three specimens in this collection; one, No. "E," belonging to Mr. Ota, collected at Nagoya, Owari; another adult (♂) in fine plumage, collected by Dr. Ijima near Tokyo, November 23, 1890 (Sc. Coll. No. 1384); and finally a young male (No. 1377), collected at Waseda, Tokyo, by Mr. Makino, about the middle of October, 1890.

The young plumage of this species has not yet been described, and a few remarks on the present specimen may therefore be welcome. It is in transition from the young to the adult stage, and shows the former to differ very materially from the latter: Superciliary stripe, chin, and entire throat pale straw color; top of head, hind neck, and rump pale ochraceous; shoulder-feathers cinnamon-chestnut; whole under side pale straw yellow with a strong suffusion of vinaceous-cinnamon on breast and sides; a few dusky dots on fore-neck; upper back striped with black, bay, and pale ochraceous; the cinnamon-rufous feathers of the adult plumage appear on lower back; greater and lesser upper wing coverts dark drab gray with broad pale ochraceous margins.

(287) *Acanthis linaria holboellii* (BRM.).

Like all the other Japanese specimens of Redpolls which I have seen the two males before me (Sc. Coll. Mus. Nos. 1375 and 1376) belong to the long-billed coast form. Collectors in the northern island should be on the lookout in winter for the short-billed white-rumped *A. exilipes*.

(280) *Fringilla montifringilla* L.

A ♂ of this species from Nagoya is interesting because partly albinistic. Chin and throat are abruptly pure white, while the rest of the plumage appears to be normal.

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I have not enumerated the following three species with the rest, because there is reason to believe that they should not be included in the Japanese fauna upon the evidence furnished by the specimens treated of.

*Erithacus sibilans* (SWINH.).

Dr. Ijima informs me that the specimen sent (No. 789) was purchased December 7, 1887, probably from a dealer in cage birds. He adds that its Japanese name is *Shima-goma*, and that some of the dealers in whose shops the species is often found insist that it is a native bird found at Nikko and other places.

This is a rare species, hitherto only found on the mainland, and its occurrence in Japan needs confirmation, though not improbable, as it has been taken in Korea. It may be recognized by its russet tail and whitish under parts, with the feathers on throat and breast margined with dusky, giving these parts a scaly appearance.

*Lanius sphenocercus* CAB.

Dr. Ijima sends a good specimen of this fine bird (No. 1000), accompanied by the following remarks:

This specimen was purchased by me November, 1889, as skin from a bird dealer. He assured me that it had been collected near Kobe (February 11, 1889), but full

reliance can not be placed in his statement, though I see no reason why such a bird should have been imported to Japan either as skin or in the living state.

As this species is found in Korea, its occasional occurrence in Japan is not improbable, though additional evidence is necessary to establish it as an undoubted member of the fauna.

*Munia atricapilla* (VIEILL.).

A specimen (No. "G") is among the birds sent, but it evidently either introduced or perhaps only an escaped cage bird. However, Dr. Ijima writes in regard to it as follows:

A pair of this species was captured in the vicinity of Lake Suwa, in the province of Shinano, August, 1895. One escaped, and the other died after a few days' captivity. The latter was skinned by Mr. Kanai, and is the bird marked "G." I can not entirely suppress a doubt that the specimen is an escaped cage bird. Mr. Kanai, however, tells me that this year another specimen was obtained in the same locality.

It may be that the specimens in question are part of a colony originating from escaped cage birds.

The bird before me has the entire head and neck deep black with a greenish gloss; upper parts pale cinnamon-chestnut, deepening into burnt Sienna on the rump and upper tail-coverts; tail above edged with dull rufous orange; under parts bright chestnut-bay gradually darkening into blackish on middle of abdomen and under tail-coverts; under wing-coverts cream color, the larger and median series dull cinnamon-rufous.

## NOTES ON THE CUBITAL COVERTS IN THE BIRDS OF PARADISE AND BOWER BIRDS.

BY  
LEONHARD STEJNEGER.

In a very interesting paper recently published \* Mr. Goodchild makes out that there is an essential difference in the arrangement of the cubital coverts of the *Paradisæidæ* as compared with the rest of the *Passeres*, and classes the wings of the former, so far as this feature is concerned, under the heading of "the Cypseline Style," that is, the arrangement as found in Hummingbirds and Swifts, *Cypseliformes*, consisting in the absence of median coverts.

Here is what he says in relation to the subject (p. 322):

In the *Paradisæidæ* every individual I have examined showed the whole of the feathers above the major coverts lying with distal overlap, and with, generally, much the same arrangement as in the *Cypseliformes*. The number of rows, however, is considerably increased in the group under notice.

And a little further on:

These [the *Passeres*] generally possess, in addition to the marginals seen in the *Cypseliformes*, one row of minor coverts, with distal overlap, see figure of Skylark (Fig. 4), and one row of medians, whose overlap is generally *proximal* throughout nearly the whole of this large group. The *Corvidæ* (see Fig. 5) differ slightly from the normal type, inasmuch as a few of their anterior medians overlap distally. In this respect they make an approach, superficially, to the *Paradisæidæ*, as they are commonly believed to do in some other respects.

Before proceeding further I will state that an examination of a number of species of *Paradisæinæ* in the U. S. National Museum has led to an entirely different result, inasmuch as I find at least three of the middle median coverts to have proximal overlap, consequently to be normally passerine and not cypseliform. In most species it is extremely difficult to make out the correct position of these feathers (at least in museum skins) inasmuch as their webs have but little cohesion and consequently they become easily disarranged. In a few, however, in which the margins of the feathers are differently colored, or of a metallic gloss, the true arrangement may be very plainly seen. Take, for instance, a full grown male of *Schlegelia wilsoni* (U. S. Nat. Mus. No. 113848), and it needs but a glance to convince us that of the series overlaying the greater coverts, viz, the medians, three of the anterior

\* The Cubital Coverts of the Euornithæ in Relation to Taxonomy. < Proc. Roy. Phys. Soc., Edinburgh, x, pt. ii (session 1889-'90), pp. 317-333 + pl. xv.



ones overlap distally while six posterior ones overlap *proximally*, and, moreover, that there is above them a well differentiated series of minor coverts (as distinguished from the marginals) the overlap of which is distal; in other words: The arrangement is absolutely in every particular as described by Mr. Goodchild for the *Corvidæ*. If any one will take the trouble to examine Mr. Goodchild's own figure representing the cubitals of a Bird of Paradise (Fig. 3), he will find that in the row of medians there are two feathers with *proximal* overlap, thus differing materially from his description.

It is plain from the above that the *Paradisæinæ* proper form no exception from the genuine passerine arrangement of the cubitals.

Mr. Goodchild makes out another exception,\* however, for later on he states that the Bower Birds (which I regard as a subfamily of the *Paradisæidæ*) have a picarian arrangement of the minor coverts: "In these more than one row of minor coverts occur, each with proximal overlap." He even goes so far as to admit as a possibility that subsequent research may prove that the birds in question rightly belong to the Picarians and not to the Passeres at all (not to speak of his classing the Bower Birds with the *Cotingidæ* among the *Mesomyodi*).

With a splendid male of *Ptilonorhynchus violaceus* (U. S. Nat. Mus. No. 121196) before me, I must again disagree with Mr. Goodchild's conclusions. The firm structure of these feathers, coupled with the metallic gloss of the margins, makes it easy for us to observe that a few of the anterior medians have distal overlap, while at least eight of the same series overlap proximally, and that the first row of minors overlap distally as in a well regulated passerine bird they ought to do.

There can, therefore, be but little doubt that the Bower Birds in these respects conform with the Paradise Birds and with the *Corvidæ*. Mr. Goodchild's "Tabular View," on page 331, is thus fortunately purged of a feature which might be urged as a reason against the view held by him of the great value of the cubital arrangement for classificatory purposes, a view which I am happy to say that I have held ever since I gave ornithological classification any thought, but of which I became somewhat doubtful when I saw the *Paradisæidæ* separated from the other Passeres and included in a group with the Hummingbirds, Swifts, and Trogons.

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\*This exception is not noted in the scheme on p. 331.

## NOTES ON SOME NORTH AMERICAN SNAKES.

BY

LEONHARD STEJNEGER,

*Curator of the Department of Reptiles and Batrachians.*

*Rena humilis* B. & G.

The Museum has recently received from Mr. Herbert Brown, Tucson, Arizona (who on several occasions has favored us with valuable material), four specimens of this worm-snake, making the first record of this rare species from eastern Arizona. They are especially valuable because they show the individual variation both in the position of the eye and the width and shape of the median cephalic series of scales.

We have now specimens from southern California, from Yuma, from Tucson, and from the Cape region of Lower California. Professor Cope has recorded it from Batopilas, Mexico (Proc. Amer. Philos. Soc., XVIII, p. 262), though no reference to this locality is found in his Catalogue of Batrachians and Reptiles of Central America and Mexico (Bull. U. S. Nat. Mus., No. 32, 1887).<sup>\*</sup> It also occurs at Colima, on the west coast of Mexico, if I am not mistaken in referring Bocourt's *Siagonodon dugesii* (Miss. Sc. Mex., Rept., livr. 8, 1882, p. 507, pl. XXIX, fig. 9, pl. xxx, fig. 4), as a synonym to the present species. I can find no character in the description, nor in the figures, by which to separate it from *R. humilis*.

*Leptotyphlops dulcis* (B. & G.).

*Stenostoma* being preoccupied, *Leptotyphlops* of Fitzinger, the next name in point of date, takes its place, and from this the family will have to be called *Leptotyphlopidae* instead of *Stenostomidae*, or *Stenostomatidae*. *Glauconia* is two years younger than *Leptotyphlops*.

A specimen (No. 15534) collected in Cook County, Texas, was recently obtained from Mr. G. H. Ragsdale, which is remarkable for the height of the anterior labial, this shield having the same size and proportions as in the *L. albifrons* figured by Bocourt (Miss. Sc. Mex., Rept., livr. 8, 1882, pl. XXIX, fig. 10<sup>a</sup>), though otherwise quite normal.

In a good series of undoubted *L. dulcis* I find considerable variation in this respect, and the difference is probably of no consequence. This peculiarity, however, led to an examination of the literature and to a comparison of the specimen with Garman's description of *Stenostoma*

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<sup>\*</sup> *Op cit.*, p. 63, *Stenostoma dulce* is given as from Batopilas. I am unable to say which of the two identifications is the correct one.

*rubellum*, from Uvalde, Texas (Rept. Batr. N. Am., I, 1883, Ophid., p. 130). He distinguished it from *L. dulcis* first by the number of scale rows being fourteen and not fifteen, but Cope has already shown the latter number to be erroneous (Proc. Phila. Ac., 1861, p. 305). The next point of difference is the "complete separation of nasals by the rostral," but this is the case in every one of the nine specimens of *L. dulce* examined by me, including the type. The next character relied upon is the number of infralabials, these being five in *rubellum* and four in *dulcis*, but here the original description of the latter is again at fault, for in the type I count five infralabials. Finally *rubellum* is stated to have "only the anterior parietal (*i. e.*, postocular) in contact with the posterior labial," implying that in *L. dulcis* the posterior parietal (*i. e.*, the parietal proper) is also in contact with the posterior labial. So it is also described in the original description, and, moreover, an examination of the type shows that this is the condition of the left side of its face, while on the right side the two shields in question are separated by another smaller shield, the normal condition, which is found in all the other specimens. There can, accordingly, be no doubt that *S. rubellum* is only a synonym of *L. dulcis*.

The occurrence of *L. dulcis* so far north is highly interesting, being the northernmost locality on record, as Cook County adjoins the Indian Territory.

***Lampropeltis multistrata* KENN.**

A young specimen of this rare species was received through Dr. Timothy E. Wilcox, U. S. Army, from Glover P. Wilcox, who collected it at Fort Niobrara, Nebraska (U. S. Nat. Mus. No. 16108), thus confirming my suspicion that the habitat of the type specimen, as originally given by Kennicott, was correct, viz, Fort Lookout, Nebraska, and that the later substitution of Fort Benton, Montana, rests on an error (see Coues and Yarrow, Bull. U. S. Geol. and Geogr. Surv. Terr., IV, 1878, p. 284).

This specimen, although agreeing with the type in the more important features, for instance, scale-rows twenty-three, and temporals two and three, differs in many others. Thus the supralabials are seven and not eight, as in the type, and the coloration is still more aberrant, for while in the type the white dorsal interspaces hardly average more than three scale-rows, in the Niobrara specimen they are nearly twice that width; but as the red spots in the latter are rather narrower, the number of white spaces between head and vent is nearly alike, viz, twenty-eight in the latter and thirty-one in the type. While in the type, however, the black bordering to the red spots descends as far down as to encroach upon the gastrosteges, in the Niobrara specimen they do not touch the gastrosteges at all; in the latter there is, moreover, a very distinct black postocular black spot covering the lower postocular and the lower temporal, a mark not found in the type.

*Lampropeltis annulata* KENN.

Two specimens (17031-17032) recently received from Cameron County, Texas, consequently from near the type locality, bear out fully the characters ascribed to this form as distinguished from *L. gentilis*.

This species has suffered considerably at the hands of herpetologists in spite of the pretty good original description by Kennicott, and the geographical distribution has accordingly been more or less in doubt.

To begin with the catalogue of the specimens in our Museum, published by Dr. Yarrow (Bull. U. S. Nat. Mus. No. 24, p. 90), two of Kennicott's original specimens, viz: Nos. 1855 (by misprint 1845) and 425, are enumerated under *L. gentilis*, while under *L. annulata* proper No. 1857 (=4293) is the type. The other specimen enumerated under the latter name is no *L. annulata* at all, but a *L. pyrrhomelas*.

Kennicott's type came from Matamoras, Mexico, just across the border, while his second specimen was from the Texan town, Brownsville, just opposite. Cope, in preliminarily mentioning Kennicott's new species enumerated a specimen from Texas. (Pr. Phil. Ac., 1860, p. 257.) In 1875, in his Check List, etc. (Bull. U. S. Nat. Mus. No. 1), on page 36, the habitat of *L. annulata* is given as "Kansas, Arkansas, and Texas," while on page 81 it is stated to be one of the "species confined to the Texan district." Naturally looking for the species (or subspecies) in his "On the Zoological Position of Texas" (Bull. U. S. Nat. Mus. No. 17, 1880), one is disappointed at finding no reference to it whatsoever. Again, as the type was from Mexican territory, one might expect to find a reference to it in his Catalogue of Batrachians and Reptiles of Central America and Mexico (Bull. U. S. Nat. Mus. No. 32, 1887), but it is not there, not even among the synonyms.

Under these circumstances it seems advisable to record any additional specimens which might throw light on the geographical distribution of this form, and to mention that the National Museum, in addition to those already enumerated, possesses a specimen from San Antonio, Bexar County, Texas (No. 7116).

*Lampropeltis rhombomaculata* (HOLB.).

Until a very few years ago this snake was considered a southern species confined to the Carolinas and Georgia. In 1888 I myself collected one opposite Georgetown, in the District of Columbia, on the Virginia side of the Potomac (U. S. Nat. Mus., No. 15329), and Dr. A. K. Fisher obtained another near Alexandria, Virginia, (Cope, Pr. U. S. Nat. Mus., 1888, p. 381). A third (No. 13613) is in the Museum from Virginia probably not far from Washington, Geo. Shoemaker, collector, and a fourth from Dunn-Loring (No. 17444) collected by Mr. Figgins, September 9, 1890. These were all from the Virginia side. In 1889, however, one was collected by Mr. Charles W. Richmond, at Bladensburg, Md. (No. 17294), and in 1890 two were taken in Brookland, Dis-

trict of Columbia (No. 16392), by Mr. Holton, and No. 16380 by Prof. W. B. Barrows. During the present year Mr. Audubon Ridgway secured a third specimen in the same suburb of Washington within a few hundred feet of where the others were taken.

*Drymobius margaritiferus* (SCHL.).

Schlegel described his *Herpetodryas margaritiferus* from a specimen in the Paris Museum, "découvert à la Nouvelle Orléans par M. Barabino." Duméril, however, in the *Erpétologie générale*, VII, p. 540, says that "L'individu type de l'*Herpetodryas perlé*, de M. Schlegel, à été adressé de New York par M. Barabino," but adds that since then several other specimens had been received, among them "quatre autres originaires, les uns du Mexique, les autres de la Nouvelle-Orléans." The latest author to report upon the snakes in the Paris Museum, Mr. Bocourt (*Miss. Sc. Mex., Zool., Rept.*, p. 718, 1890) only remarks, "La collection erpétologique du Muséum renferme de nombreux individus de cette espèce: les uns ont été recueillis par M. Barabino dans le sud des États-Unis."

As will be seen, the authenticity of the early records of this species having been found within the United States are somewhat defective, and the definitive location of it within our boundaries is therefore very interesting. The proof is furnished by four specimens (U. S. Nat. Mus. Nos. 17069-17072), which were collected in Cameron County, the southwesternmost county of Texas.

*Tropidoclonion lineatum* (HALLOW.).

Mr. Julius Hurter has recently discovered this species in St. Louis, Missouri, and presented the Museum with several specimens (16485-16487). I found the ground color (which was drab in the living specimens) to vary a great deal in shade, some being lighter, with the dark dots very distinct, others being darker and consequently more uniform.

With regard to the subspecies recently described by Mr. R. Ellsworth Call (*Amer. Journ. Sc.* (3), XLI, April, 1891, p. 298), as *T. l. iowa*, I can only say that I fail to discover, from his description, any difference which would separate the Iowa specimens from Hallowell's type which came from Kansas, or from those before me from Missouri. In the latter I count nineteen scale rows, the same number as given by Hallowell in the original description, as well as by Mr. Call for his subspecies, although he states that it "differs in the number of rows of dorsal scales."

St. Louis is, with the exception of Urbana, Ill., the most eastern reliable record of this species, for the specimen No. 10089, in Yarrow's catalogue of specimens in the U. S. National Museum (*Bull.* 24, U. S. Nat. Mus., p. 131), given as *T. lineatum* is really a *Storeria occipitomaculata*, and the locality "Hughes, Ohio," for the present species should therefore be eliminated.

The occurrence of *T. lineatum* in the very city of St. Louis is so interesting that I asked Mr. Hurter for more detailed information, which he kindly furnished in a letter of October 11, 1890, in which he writes as follows:

This snake is only found, to my knowledge, along the river front near the Arsenal grounds in the city of St. Louis. The place in which it is found covers a space of about three blocks and consists of an abandoned and partly refilled quarry. Here they live among rocks, in the ground and under bushes, feeding on worms and insects, a fact which I ascertained by examining the contents of their stomachs. They were very common some three years ago, but are now getting scarce owing to the location being utilized for railroad purposes. Having kept specimens in captivity I am able to state that this species is viviparous, one of them bringing forth as many as six young ones.

*Contiophanes imperialis* (BAIRD).

Two specimens of this rare snake have recently been collected in Cameron County, Texas (U. S. Nat. Mus., Nos. 17067, 17068).

I have but little hesitation in referring to this species as a synonym Peters' *Dromicus clavatus*,\* for although the reference of the latter to the genus *Dromicus* implies that the posterior teeth are not grooved, yet the descriptions and figures agree so absolutely with my specimens of *C. imperialis*, in which the posterior teeth are certainly grooved, that I am forced to believe that Peters did not examine the dentition, or, what is more likely, that the posterior teeth had been broken off in the unique example at his disposal. How natural it would be for Peters to refer this species to *Dromicus* (or rather to *Rhadinæa*, the species of which both Peters and Günther refer to *Dromicus*) when ignorant of its dentition, may be easily understood when one reflects that Cope has repeatedly referred to the present species as "*Rhadinæa imperialis*."

*Leptodeira septentrionalis* (KENN.).

An additional specimen (U. S. Nat. Mus. No. 17066) has recently been received from Cameron County, Texas, not far from the locality of the original type. The tail is less than one-fourth the total length; twenty-three scale rows.

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\*Cope, Bull U. S. Nat. Mus., No. 32, 1887, p. 79, quotes "*Dromicus clavatus* Günther," with the habitat Guatemala. Is this intended to be the same species? Peters' specimen came from "Mexico."



## NOTES ON THE GENUS SITTASOMUS OF SWAINSON.

BY

ROBERT RIDGWAY,  
*Curator of the Department of Birds.*

In his recently published catalogue of the Tracheophonæ,\* pages 118-121, Dr. P. L. Sclater recognizes three species of *Sittasomus*, as follows:

1. *S. erithacus* (Licht.), "SE. Brazil, Paraguay, Bolivia, and N. Argentina." (Synonyms, *Dendrocolaptes sylviellus* Temm., and *Sittasomus temminckii* Less.)

2. *S. olivaceus* Max., "S. Mexico, Central America, and South America down to Brazil." (Synonyms, *Sittasomus griseus* Jard., *S. amazonus* Lafr., *S. sylvioides* Lafr., and *S. pectinicaudus* Cab. and Heine.

3. *S. stictolæmus* Pelz., Amazonia.

Of these three species the U. S. National Museum possesses specimens of all but the last, besides numerous examples which can not be referred to either *S. erithacus* or *S. olivaceus*. A considerable number of additional specimens have been borrowed from the American Museum of Natural History, New York City, and the Boston Society of Natural History, including the types of *S. olivaceus* Max., and *S. amazonus* Lafr., so that altogether a very fair series of the different forms has been brought together for comparison. The careful examination of this material immediately convinced me that the actual number of recognizable forms is at least double that recognized by Dr. Sclater; indeed, it is a matter of great surprise to me that forms so strongly characterized as *S. griseus* Jard., *S. sylvioides* Lafr., and an unnamed one from western Ecuador could ever have been referred to the species into which Dr. Sclater has merged them. Examination of the type specimen also shows that *S. olivaceus* Max., instead of being one of the forms which the distinguished authority cited has "lumped" under that name, is really referable to *S. erithacus* (Licht.),† and that the so-

\* Catalogue | of the | Passeriformes, | or | Perching Birds, | in the | collection | of the | British Museum. | ——— | Tracheophonæ, | or the Families | Dendrocolaptidæ, Formicariidæ, | Conopophagidæ, and Pteroptochidæ. | By | Philip Lutley Sclater. | London: | Printed by order of the Trustees, | 1890. (Constituting Volume xv of the "Catalogue of the Birds in the British Museum.")

† Mr. J. A. Allen has already made this identification (see Bull. Am. Mus. Nat. Hist., vol. II, No. 3, 1889, p. 247), but I was not aware of it until after the above was written.



called *S. olivaceus* from southwestern Brazil (presumably the same as the one occurring in Bolivia and northern Argentina) is a still different form, as is also the form inhabiting the upper Amazon Valley (*S. amazonus* Lafr.). I have not been able to inspect any example from any part of Colombia, Venezuela, or Guiana, and can not, therefore, offer an opinion as to the affinities of birds from the more northern parts of South America.

The forty-four specimens before me I find very easily separable into six groups (some, perhaps, of only subspecific rank) by the following characters:\*

*a*<sup>1</sup>. Throat not spotted.

*b*<sup>1</sup>. Pale band across inner webs of remiges very sharply defined, very distinct on secondaries as well as primaries, and in color distinctly yellowish.

*c*<sup>1</sup>. Tail and secondaries cinnamon-chestnut.

*d*<sup>1</sup>. Under parts olive-yellowish. HAB.: Brazil (Bahia, Rio Janeiro, Sapitiba, Ypanema, etc.); "Paraguay;" "Bolivia;" "N. Argentina."

1. *S. erithacus* (Licht).

*d*<sup>2</sup>. Under parts grayish olive or olive-grayish.

*e*<sup>1</sup>. Back mixed rusty and olive.†

*f*<sup>1</sup>. More olivaceous, with much smaller bill; under wing-coverts and band across remiges deeper yellowish. HAB.: Interior of southern Brazil (Chapada, Matto-grosso); Paraguay † Bolivia † northern Argentina? ..... 2. *S. chapadensis* Ridgw.

*f*<sup>2</sup>. More grayish, with much larger bill; under wing-coverts and band across remiges paler yellowish. HAB.: Upper Amazons.

3. *S. amazonus* Lafr.

*e*<sup>2</sup>. Back uniform russet-brown, very different from color of top of head. HAB.: Costa Rica (and Veragua †) to southern Mexico.

4. *S. sylvioides* Lafr.

*c*<sup>2</sup>. Tail and secondaries clear tawny. HAB.: Western Ecuador (Guayaquil, Babahoyo, Chimbo) ..... 5. *S. æquatorialis* Ridgw.

*b*<sup>2</sup> Pale band across inner web of remiges not sharply defined, very indistinct on secondaries, and in color white, or yellowish white. HAB.: Tobago, Trinidad † Venezuela? ..... 6. *S. griseus* Jard.

*a*<sup>2</sup> Throat spotted. HAB.: Upper Amazon ..... 7. *S. stictolamus*, Pelz.

The principal synonymy of these various forms is as follows:

1. *Sittasomus erithacus* (Licht.).

*Dendrocolaptes erithacus* LICHT., Abh. Akad. Berl., 1820, 259, pl. 1.

*Sittasomus erythacus* BONAP., Consp. 1, 1850, 209.—PELZ., Orn. Bras. 1871, 59.

*Sittasomus erithacus* LAFR., Rev. Zool. 1850, 5-9.—SCL., Cat. B. Brit. Mus., xv, 1890, 119.

*Sittasomus sylvellus* TEMM., Pl. Col. livr. 12, Sept. 27, 1823, pl. 72, fig. 1.

*Sittasomus olivaceus* MAX., Beitr. III, 1830 (†), 1146.

There can be no question that the type of *S. olivaceus* MAX. belongs to this species. Its coloration is a little modified by exposure to the

\* *S. stictolamus* PELZ., being also included in the synoptical table to render it more nearly complete.

† Vide PELZELN, Orn. Bras., p. 59.

‡ The colors of the rump and top of head, respectively.

light (being a mounted specimen), the plumage of the head, neck, and body being considerably duller than in other specimens of *S. erithacus*, though considerably more yellowish than in any of the seventeen examples of *S. chapadensis*, but the paler under tail-coverts, sharper outline of the yellowish spot on inner web of the fourth primary, and other characters, render the identification certain.

## 2. *Sittasomus chapadensis* Ridgw. (Sp. nov.)

- †† *Sittasomus erithacus* SCL. and SALV., P. Z. S. 1879, 622 (Bolivia).—SCL. and HUDS., Arg. Orn. I, 1888, 198 (Salta, Arg. Rep.).—BERL., J. f. O. 1887, 132 (Paraguay).  
†† *Sittasomus olivaceus* WHITE, P. Z. S., 1882, 613 (Salta, Arg. Rep.).—PELZ., Orn. Bras., 1871, 59 (Engenho de Gama and E. de Pari, Brazil).

SP. CHAR.—Much less yellowish olive than *S. erithacus*, with rufous-chestnut of wings more extended (spreading over at least terminal half of outer webs of primaries), and yellowish spot on inner web of fourth primary less sharply outlined. (Type, No. 33741, Am. Mus. Nat. Hist. Chapado, Matto Grosso, Brazil, May 16, 1885, H. H. Smith.)

## 3. *Sittasomus amazonus* Lafr.

- Sittasomus amazonus* LAFR., Rev. Zool. 1850, 590.—PELZ., Orn. Bras. 1871, 59 (Borba, Barra and Theotonio, Brazil).  
*Sittasomus olivaceus* SCL., Cat. B. Brit. Mus., xv, 1890, 119 (part).

SP. CHAR.—Much grayer than *S. chapadensis*, the under parts being dull olivaceous-gray, without the slightest yellowish cast, the top of head and hind neck similar, but darker; outer webs of primaries much less rusty, even the outermost secondaries being olivaceous rather than rusty; pale band across inner webs of remiges less yellowish; bill and general dimensions larger.

## 4. *Sittasomus sylvioides* Lafr.

- Sittasomus sylvioides* LAFR., Rev. Zool. 1850, 590 (Mexico).  
*Sittasomus pectinoides* CAB. and HEINE, Mus. Hein. II, Aug. 26, 1859, 33 (Mexico).  
*Sittasomus olivaceus* SCL., Cat. B. Brit. Mus., xv, 1890, 119 (part).

This form closely resembles *S. amazonus* in the grayness of its coloration, but is distinguished by smaller size, uniform brown back, and much deeper chestnut of wings, tail, and under tail-coverts. Possibly Colombian specimens may belong here.

## 5. *Sittasomus sequatorialis* Ridgw.

- Sittasomus amazonus* BERLEPSCH and TACZAN., P. Z. S. 1883, 562 (Chimbo, W. Ecuador).

SP. CHAR.—Top of head and hind neck grayish olive; back, scapulars, and wing-coverts raw umber brown, rather deeper on the scapulars; rump, upper tail-coverts, and tail clear tawny, or orange-tawny; secondaries similar, but rather duller. Under parts uniform pale grayish olive, except under tail-coverts, which are clear ochraceous. (Type, No. 50712, U. S. Nat. Mus., Guayaquil, Ecuador, Dr. A. Destruge.

The peculiarly light tawny-rufous, almost orange-rufous, hue of the tail, rump, secondaries, etc., strikingly different from the deep chestnut or chesnut-rufous color of the same parts in other forms, is the most obvious character of this well-marked species or race.

6. *Sittasomus griseus* Jard.

*Sittasomus griseus* JARD., Ann. and Mag. N. H., XIX, 1847, 82 (Tobago).

*Sittasomus olivaceus* SCL., Cat. B. Brit. Mus., xv, 1890, 119 (part).

With the exception of *S. stictolæmus* this is the most distinct species of the genus, differing conspicuously from all the other forms in the light olivaceous back and scapulars (concolor with the head and abruptly defined against the tawny-rufous of the rump), and in the very much restricted pale (white instead of buffy-yellowish) band across the inner webs of the remiges, this band furthermore becoming nearly obsolete on the secondaries, which likewise are without the distinct blackish subterminal space. Its characters were accurately and minutely given by Jardine in the description above cited.

7. *Sittasomus stictolæmus* Pelz.

*Sittasomus stictolæmus* PELZ., Orn. Bras., 1871, 59 (Borba, up. Amazon).—SCL., Cat. B. Brit. Mus., xv, 1890, 120.

This species, which I have not seen, differs from all the others in its spotted throat. Possibly it is not strictly congeneric with them.

## ON THE SNAKES OF THE CALIFORNIAN GENUS *LICHANURA*.

BY

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In a recent paper on some forms of the Boid genus *Lichanura* (Proc. U. S. Nat. Mus., XII, 1889, pp. 98-99) the present writer remarked "that it is more than probable that additional material will alter the above results," and that "the manifest great variability of the characters derived from the number and shape of scales and plates in these snakes makes it quite likely that some of the forms here recognized, in the future will be recognized only as varieties."

I have subsequently had the opportunity to study the extreme variability in the allied genus *Charina* (Proc. U. S. Nat. Mus., XIII, 1890, pp. 177-182), about which I had occasion to state (p. 179) that in an extensive series "no two specimens are alike as far as the plates of the head are concerned," and that "there is hardly an individual with both halves of the head alike."

These results had already greatly influenced my views in regard to the various species of *Lichanura*, and additional material since received, for which we are again under obligations to Mr. Charles R. Orcutt, of San Diego, California, has made it desirable to review the whole question.

The result would have been very unsatisfactory, however, or I should perhaps say it would have been still more unsatisfactory than even now, had it not been for the liberality of the authorities of the Philadelphia Academy of Natural Sciences, who promptly and generously granted my request for the loan of the type specimens of *L. myriolepis* and *roseofusca*.

A series of 9 specimens of these rare snakes is a material greater than any one before me has been able to compare. The enormous individual variability, which I shall demonstrate later on, renders the result, nevertheless, somewhat doubtful, and although it may be regarded as a step towards the final settlement of the question, I must still regard it as only preliminary. In treating of it I shall therefore adhere to the same conservative proceeding which I employed in regard to *Charina* (tom. cit., p. 181), viz, to recognize as distinct any form which can not be conclusively proven to be only an individual variation of some other form.

The comparative large size of the eye in *L. trivirgata*, coupled with the very pronounced pattern of coloration, might tempt one to regard it as the young of one or another of the forms since described, but the fact that the second specimen (U. S. Nat. Mus., No. 12602), although very much larger than the smallest of the other forms, in color and size of eye agrees completely with the type (No. 15502)—a very young individual—seems to prove the distinctness of this species, which has so far been found only at the southern extremity of the Lower Californian peninsula. The low number of gastrosteges may also be a character of this species.

In addition to this larger size of the eye *L. trivirgata* shows a very pronounced difference in coloration from the forms collected farther north, it being creamy white, with three broad and abruptly defined blackish-brown longitudinal bands, while the others are either entirely uniform above, or with only faint indication of brownish zigzag bands on a bluish ground. Both specimens of this form at hand are identical in this respect, although of very unequal size, and judging from the original description the only other specimens of this species recorded—at least two (see Proc. Phila. Acad., 1861, p. 304)—were of the same well-marked pattern.

The same reason which prevented us from regarding the largeness of the eye as due to young age, operates against explaining the distinct color pattern as a sign of immaturity, for the type of *L. myriolepis* is considerably smaller than Belding's specimen of *L. trivirgata*, and yet it is not more distinctly marked than all the other specimens found to the north.

As far as scutellation is concerned it may at once be stated that *L. trivirgata* shows no character (with one possible exception) by which it can be separated from the forms described as *L. myriolepis*, *roseofusca*, and *simplex*. The extent of the variability in these forms may be gathered from a glance at the table of specimens given below, to supplement which I may use the same words in which I characterized a similar condition in *Charina* (Proc. U. S. Nat. Mus., XIII, 1890, p. 179), viz, "there are no two specimens alike," and "there is hardly an individual with both halves of the head alike."

The possible exception referred to above is the low number of gastrosteges (218); but in view of the extent of variation in this respect among the other specimens (224 to 241) this character can hardly be expected to hold.

As to the forms from "northern Lower California," collected by Gabb, and those from southern Upper California, the inspection of the type specimens of *L. myriolepis* and *roseofusca* has simplified matters considerably. The former is a specimen of comparatively small size, but fairly well preserved; the latter is a skin in alcohol of a large individual and in a very bad shape. To this unfortunate circumstance is undoubtedly due the inaccuracies and incompleteness of the original

description. I have reëxamined the specimen with great care and minuteness, and with the original description before me I note the following discrepancies:

The number of scale-rows in the type of *L. roseofusca* is not thirty-six, but at least forty; the number of scales in the orbital ring is nine on one side, ten on the other, not seven and eight; anterior fused into a large preocular on one side only; loreals  $\frac{1}{2}$  on one side only,  $\frac{3}{2}$  on the other.

When I add that I have only been able to count forty-three scale-rows in the type of *L. myriolepis*, it will be seen that the difference between the alleged two species, or varieties, has been reduced to a difference of three scale rows, as the slight difference in coloration, now entirely obliterated, is hardly worth mentioning, the other specimens showing that no line can be drawn in this respect. The difference alluded to is so slight, however, and the irregularity of the number of scale rows in the same individual so great, that I have no hesitation in now pronouncing *L. roseofusca* and *myriolepis* to be the same thing, and as the former name is mentioned first, the species will have to take that name.

Practically identical with these specimens are three others received from Mr. Orcutt (U. S. Nat. Mus., Nos. 16327, 16850, and 14129). They demonstrate the great variability of the scales which have been called subloreal (those written below the line in the diagnoses), though in reality only detached pieces of the supralabials\*), and, on the other hand, they seem to establish the number three as the characteristic number of the true loreals.

The type of *L. simplex* (U. S. Nat. Mus., No. 13810) agrees in the main with the above, the only difference consisting in the small number of scales in the eye-ring. But as the number varies between nine and ten in the other specimens, and as the paucity is due to the plain and irregular fusion of several of the scales, I have no hesitation in saying that the above name should in the future only figure in the synonymical lists of *L. roseofusca*.

The status of *L. orcutti* differs materially from that of the names already discussed. The low number of scale rows stands so far unapproached, but for its distinction I rely more upon the number of true loreals, which is only two though in all the other specimens of the genus there are three true loreals. This low number is not due to fusion of any two shields, nor to a shortening of the distance between the eye and the nostril. In addition hereto we have the unusually protruding rostral, so that, all taken into consideration, *L. orcutti* seems to be the

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\* It will be seen that I have altered somewhat the loreal formula of the specimens previously described by me, in as much as I have not here recognized any supraloreals. I was then quite uncertain as to what shields Professor Cope included among the "loreal" of his original descriptions, but after having seen his specimens I have modified my nomenclature so as to be comparable with his.

best differentiated form of the group. In the features here referred to none of the other specimens offer an approach, so that I have no other choice but to regard it as a good species.

Its status is somewhat like that of *Charina brachyops* as compared with *Ch. plumbea*, and resting as it does upon only a single specimen the connecting link may some day turn up. Then will be the time to drop it, but not till then.

I am thus forced to recognize, for the present, three species which may be distinguished as follows:

- a<sup>1</sup> Eye large, its diameter more than one-third the distance from anterior canthus to tip of muzzle; gastrosteges about 218; color whitish with three blackish-brown longitudinal bands in strong contrast.....1. *L. trivirgata*.
- a<sup>2</sup> Eye smaller, its diameter, one-third or less the distance from anterior canthus to tip of muzzle; gastrosteges 224-241; color brownish or bluish above, with or without longitudinal bands, which, when present, contrast but little against the ground color.
- b<sup>1</sup> True loreals, 3; scale-rows, 39-43.....2. *L. roseofusca*.
- b<sup>2</sup> True loreals, 2; scale-rows, 35.....3. *L. orcutti*.

List of specimens examined.

Species.	Museum and number.	Collector.	Locality.	Scale-row.	Scales in eye-ring.	Loreals.	Ratio of diameter of eye to its distance from tip of snout.	Gastrosteges.	Total length (millimetres).	Tail (millimetres).	Remarks.
<i>L. roseofusca</i> .....	Phila. Ac. ....	W. M. Gabb .....	Lower California.....	40	9-10	—	—	224	518	66	Type: Mutil. skin.
<i>L. (myriolepis)</i> .....	do .....	do .....	do .....	43	10-10	—	1:3	226	518	66	Type.
<i>L. (simplex)</i> .....	U. S., 13310.....	Rosa Smith .....	San Diego, Cal. ....	40	7-8	—	1:4	232	765	80	Do.
<i>L. roseofusca</i> .....	U. S., 16377.....	C. R. Orcutt .....	San Diego County, Cal. ....	43	9-9	—	1:3.4	233	695	90	Tail defective.
<i>L. roseofusca</i> .....	U. S., 16350.....	do .....	do .....	39	9-10	—	1:3.75	241	775	60	Type.
<i>L. roseofusca</i> .....	U. S., 14129.....	do .....	San Diego, Cal. ....	43	9-10	—	1:3.3	232	860	117	Do.
<i>L. orcutti</i> .....	U. S., 15503.....	do .....	Colorado Desert, Cal. ....	35	9-10	—	1:3.7	232	870	110	Median upper loreal counted as one, though divided horizontally.
<i>L. trivirgata</i> .....	U. S., 15502.....	J. Xantus .....	Cape San Lucas, Lower California.....	40	10-11	—	1:2.5	218	305	33	
<i>L. trivirgata</i> .....	U. S., 12602.....	L. Belding .....	La Paz, Lower California.....	41	9-10	3-4	1:2.4	218	635	95	





## NOTES ON COSTA RICAN BIRDS.

BY

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The present notes are based on the remainder of the collection from which the new species were described in a former paper in these Proceedings,\* and is really a continuation of that paper. I have, however, added some few notes from observations made on birds in the Costa Rica National Museum since my return.

I would here express my thanks to the authorities of the Smithsonian Institution for the opportunity of examining their bird collection in comparison with Costa Rica examples, and also acknowledge my indebtedness to Mr. Ridgway and Dr. Stejneger for much kindly assistance.

### *Catharus melpomene.*

In a series of twenty-seven adult birds of this species, fifteen from the vicinity of San José, five from various other localities in Costa Rica, and seven from Guatemala and Mexico, no differences due to locality, age, season, or sex are observable that have not already been noted by various writers.

### *Catharus mexicanus.*

I have before me a single specimen, a young male *Catharus*, which, although Mr. Ridgway has separated the Costa Rica bird (or a form of it) as *fumosus*, I believe is *mexicanus*, having the wings and tail "dusky brown with bistre brown edgings," and many feathers of the back with a decided brownish cast.

The specimen (No. 636, Museo Nacional de Costa Rica, Jiménez, August 4, 1886, A. Alfaro) may be described as follows:

Above brownish olive, head slightly darker, feathers blackish basally, and having narrow ochraceous shaft-streaks. Scapulars with sub-terminal elliptical ochraceous shaft-spots, feathers, narrowly tipped with blackish. Greater coverts dusky brownish with bistre edges, somewhat brighter than on the quills. Many of the feathers of the back with a decided Vandyke-brown shading. Tips of upper tail-coverts Vandyke-brownish. Tail like the wing. Below, feathers of the

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\* Vol. xiv, pp. 337-346.

throat ochraceous-buffy with whitish bases and narrowly tipped with blackish. Breast olivaceous, becoming grayish or ashy posteriorly. Feathers of the center of the breast with large central ochraceous-buff spots surrounded with narrow blackish lines and the feathers edged with olivaceous; sides smoky gray with olive wash; center of belly almost pure white, only a few feathers anteriorly with subterminal buffy tips and dusky edges. Under tail-coverts pale buffy.

There are no specimens of *C. mexicanus* in the U. S. National Museum collection and only the type of *C. fumosus*.

***Campylorhynchus capistratus.***

Two specimens (No. 19, ♀, Museo Nacional de Costa Rica, San Mateo, January, 1886, A. Alfaro; and No. 18, ♂, Trojas, February, 1886, A. Alfaro), compared with Mr. Ridgway's type of *C. castaneus* and six examples of *C. capistratus* in the U. S. National Museum (two from Sneyá, Nicaragua, one from San Juan del Sur, one from La Palma, and one from Punta Arenas, Costa Rica) seem to be nearer the former than the latter in the lighter almost uniform chestnut of the back and less conspicuous spots and streaks of black and white. No. 18 corresponds very closely in size to *castaneus*, while No. 19 is larger; as large as other specimens of *capistratus*.

Female examples in the Costa Rica National Museum seem to have the streaking and spotting of the back a little less pronounced than in the males.

***Henicorhina prosthaleuca.***

Mr. Zeledon gives in his list *H. leucosticta* as a Costa Rica bird. However this form probably does not occur in Costa Rica, as the name *leucosticta* is applicable to the black-headed form, which occurs only as far north as Colombia, its place in Central America being taken by *H. prosthaleuca*. (See Catalogue Birds Brit. Mus., Vol. VI, pp. 286-288.)

***Henicorhina leucophrys.***

I have before me two skins from the Costa Rica National Museum. No. 2300, ♂, (Volcan de Poás, November 23, 1888, A. Alfaro), agrees closely with descriptions of the species, and also with ten examples in the U. S. National Museum, from Mexico, Guatemala, Costa Rica, Veragua, and Bogota. There are, however, four of the examples from Costa Rica in the U. S. National Museum collection which seem to present some peculiarities or characters which may be variations due to their geographical position. The local variations in the species as compared with Costa Rican examples can best be pointed out by making extracts from Mr. Ridgway's manuscript on the subject, which I have before me. The Costa Rica birds "come nearest to the Guatemala specimens, but are somewhat lighter and brighter brown above." Mexican specimens "have the entire pileum and hind neck exactly the same color as the back, except along the lateral margin, where a black line

borders the white superciliary stripe;" the rest of the upper parts are "almost exactly as in specimens from Costa Rica." Costa Rican and Veraguan specimens have "the feathers of the throat distinctly edged with dusky, producing streaks."

The second skin from the Costa Rica National Museum differs so much from other examples that I append a description. More material might prove it to be distinct.

No. 2299, ♀, Collection Museo Nacional de Costa Rica, El Achiote, Costa Rica, November 22, 1888, A. Alfaro. Above similar to other Costa Rica examples of *H. leucophrys*, but with the entire head uniform, dusky black, almost imperceptibly tinged with olive. Frontal feathers white, but more of a yellowish hue than in the narrow white superciliary stripe. Lores and a stripe extending through the eye black. Sides of the face and neck white, streaked with black; the feathers white, having black edges. The back is chestnut-brown, brighter on rump and upper tail-coverts, washed with olive on the upper back; wing-coverts same color as the back; quills dusky blackish, outer webs like the back, barred with blackish, the bars or mottling extending across the inner secondaries. The outer primary is edged with white on the outer web. Tail dusky brownish black, barred irregularly with black. Throat white, feathers with indistinct dusky edgings; foreneck and breast ash-gray, lighter on the lower breast, and distinctly barred with blackish. Sides, flanks, belly, and crissum light rufous-chestnut; the under tail coverts, however, barred with black.

Since returning to Costa Rica I find in the collection of the Museo Nacional another specimen, with head uniform dusky black and the lower breast ash-gray barred with blackish, also having the under-tail coverts barred with blackish; otherwise there is no difference from other Costa Rica examples; and being taken at the same time and in the same place with normal examples, I now conclude it is only a peculiar phase of plumage.

*Thryophilus rufalbus oastanonotus.*

Five adult specimens before me are typical of the sub-species, by comparison with the type. No. 2067, Museo Nacional de Costa Rica, is a young bird evidently not long from the nest and differs from descriptions of young only in having the under-tail coverts faintly barred with blackish.

*Thryophilus costaricensis.*

A comparison of three specimens from the Museo Nacional de Costa Rica with six other examples from Costa Rica, and one from Nicaragua (Los Sábalo) in the U. S. National Museum, with five Panama specimens of *castaneus*, leaves no doubt as to there being well defined races if not species. The Costa Rica specimens are all a bright uniform chestnut below, while the Panama examples are orange-rufous conspicuously

barred on the sides and flanks with blackish; also, as pointed out by Mr. Sharpe (Col. Birds Brit. Mus., vi, p. 217), the white on the throat in Costa Rican birds "is confined to the throat itself and not extending to the fore-neck." In the series before me there are no intermediate or connecting forms. However, Nos. 47386, 64697, and 116552, from Costa Rica, and No. 91145, Los Sábalo, Nicaragua, in the U. S. National Museum series, do present a few ill-defined blackish bars on the flanks. The last specimen is a young bird with the under surface slightly paler chestnut than in the adult. There is also a female example in the Costa Rica National Museum collection (No. 3352, Jiménez, August 18, 1888), with a few blackish bars in the center of the belly.

***Thryophilus thoracicus.***

Out of a series of seventeen specimens examined, eleven from the U. S. National Museum collection and six from the collection of the Costa Rica National Museum, only one presented the upper tail-coverts obscurely barred with blackish as indicated by Mr. Sharpe (Vol. VI, Cat. Birds Brit. Mus., p. 215); with that one exception all have the upper tail-coverts unicolored, without sign of bars.

***Thryophilus modestus.***

The throat and breast of young birds of this species are far more of an ashy white than in the adult form; and the sides, flanks, and crissum are a soft buff, much paler than in the adult.

In a series of twenty-three Costa Rican birds no peculiarities are noticeable that are not to be found in the Guatemala bird; while no intermediate forms are found grading into the Panama *T. galbraithi*.

For further notes on this species see the author's list of birds of San José, Costa Rica, in *The Auk*, July, 1891, p. 275.

***Thryophilus zeledoni.***

A comparison of seven of these birds with the series of twenty-three *T. modestus* from Costa Rica only goes to point out more conclusively their specific distinctness. Not only is the great difference in size constant, but also the color; no intermediate birds are found.

***Thryophilus semibadius.***

Four specimens, two males and two females, from Pozo Azul, Costa Rica (Nos. 919, 920, 921, and 922, Museo Nacional de Costa Rica), agree very closely with the descriptions of the type specimen as given by Mr. Sharpe, and also as given by Salvin and Godman. Yet from the material before me I conclude the description is drawn from a bird not altogether mature. However, the type comes from Panama and the differences pointed out below may be confined to a more northern race of the bird.

No. 919 (October 20, 1883, ♀), I take to be a bird of the year. The chestnut above is softer than in other examples; the wing-coverts, greater, middle and lesser series all being blackish, edged (or better, perhaps, mottled), especially on the outer web, with pale or rufous chestnut, paler than the back; primary coverts edged with the same color; primaries and secondaries blackish brown, secondaries the darker; first two primaries edged (not notched) with whitish, third edged and slightly notched, the remaining primaries and the secondaries barred with rufous-chestnut, the bars extending across the inner secondaries. The throat is ashy white, scarcely immaculate. No. 921 (♂ January, 1887) has some of the middle and lesser coverts barred with white; also the primary coverts notched and edged with fulvous-whitish; greater coverts like in the preceding example. Primaries and secondaries barred, commencing with whitish on the outer primaries and growing darker until on the inner secondaries it is rufous-chestnut. In this specimen the scapulars are barred with black, the bars, however, almost entirely concealed. The bars are well defined, much better so than the bars on the upper tail-coverts. These bars are to be seen more or less clearly defined on all of the specimens before me. No. 922 (♀ January, 1887), has all the wing-coverts barred with whitish; the primary coverts are brownish dusky, faintly edged and notched on outer webs with rufous and whitish, the white predominating. In all the specimens before me I would call the under surface of the quills dusky edged on inner webs with buffy ash, not, as Mr. Sharpe says, "Quills dusky brown below, ash brown along the edge of the inner web."

*Thryothorus hyperythrus.*

In a single specimen in the author's collection from the Pacific side of Costa Rica, the orange-rufous of the under parts is slightly paler than in an example from Santa Fé, Veragua, and slightly darker than one from Colovevora, Veragua. In each of these examples there is just a perceptible lightening in color in the center of the belly. Arranging the three specimens spoken of above with three others, one from Panama and two from Tobago,\* there is an unbroken series, the center of the belly growing lighter until the last, Nos. 74892 and 82728, U. S. National Museum, where the center of the belly is white. In this example neither is the light rufous-brown of the head so light, nor does it extend so far back as in northern specimens.

*Thryothorus melanogaster.*

Male (No. 908, Museo Nacional de Costa Rica, Pozo Azul, Pirris, December 8, 1885; José C. Zeledon):

According to Mr. Sharpe *T. fasciiventris* does not occur in Costa Rica, its place there being taken by *T. melanogaster* (Cat. of Birds, Brit. Mus., Vol. VI, pp. 230, 231), an opinion in which I now fully concur.

\*These Tobago specimens are not *T. hyperythrus*, but *T. rutilus* Vieill.—R. R.

However, in making a comparison of the specimens with Mr. Sharpe's descriptions and with the other specimens in the National Museum collection, I was much puzzled, not only in regard to the Costa Rica example, but also with examples of the species (in a comprehensive sense) from Veragua, Panama, and Santa Marta, Colombia. Mr. Ridgway has greatly aided in making clear the comparative differences in placing at my disposition his unpublished manuscript and published notes on the very birds I have before me. In an article published in the Proceedings of the Boston Society of Natural History, Mr. Ridgway points out the difference between the type of *T. fasciiventris* and the Santa Marta specimen as being greater than that between the latter and the Panama specimens, and equivalent to the resemblance between Panama and Santa Marta examples as compared with Costa Rican and Veraguan specimens. Mr. Ridgway then says: "*T. melanogaster* may, however, be distinguished by the pale rusty brownish, instead of white bars on the under tail-coverts, and much less distinct (sometimes quite obsolete) bars on the sides, flanks, and abdomen." Then "there can be no question, however, that this form grades directly into the Panama form, which in all probability is only a local race of *fasciiventris*."

With this latter view I can hardly agree, there being other differences overlooked by Mr. Ridgway that seem to me to very clearly separate the birds as species. These differences consist in the Costa Rican and Veraguan specimens having a rufous tail (somewhat paler than the back) barred with black; whereas the Santa Marta and Panama birds and type of *fasciiventris* have the tail dusky, narrowly banded with pale fulvous (Ridgway MSS). Also the bands on the upper tail-coverts, primaries, and secondaries in the Costa Rican and Veraguan specimens are obsolete or barely perceptible, to be seen only in certain lights. In the Panama and Santa Marta examples these bands are very distinct; not so distinct, however, in the type of *T. fasciiventris*.

As Mr. Sharpe's descriptions of *T. fasciiventris* and *T. melanogaster* appear to me somewhat faulty and misleading, I will present here, from Mr. Ridgway's manuscript, descriptions of the type of *T. fasciiventris* and a Costa Rican example of *T. melanogaster*:

***Thryothorus fasciiventris*.**

SP. CHAR.—Adult (Type, No. 2658, Lafresnaye Coll., "Bogota"): "Above light Vandyke-brown, somewhat tinged with russet (lighter and much duller than in No. 34095, U. S. Nat. Mus., from Sta. Marta), the pileum decidedly duller (the feathers much worn, however); \* secondaries without the faintest indications of bars, and edges of primaries with only the slightest possible suggestion of bars, discernible only on the closest inspection; tail dusky, narrowly banded with pale fulvous, the bars confined to outer webs (where extending to shafts), the inner webs, even of

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\* A few scattered feathers, evidently of newer growth, are very similar in color to those of the back.

middle feathers, almost wholly uniform dusky. A narrow white superciliary stripe, and beneath this a transocular stripe (about 0.10 to 0.15 wide), occupying lores and upper portion of auriculars, similar in color to the pileum. Chin, throat, chest, and sides of head up to the brown transocular stripe, immaculate, pure white; rest of lower parts dull, blackish dusky, tinged with brown (especially on flanks and upper breast), and everywhere barred with white, these white bars rather narrower and more tinged with brown on upper part of breast, the lateral portions of which are less distinctly barred; thighs light brown with very indistinct narrow darker bars on inner side. Length (mounted specimen), about 5.60; wing, 2.55; tail, 2.10; exposed culmen, 0.70; bill from nostril, 0.48; depth at anterior end of nostril, 0.17; tarsus, 0.90.\*

"This specimen, which is an adult in considerably worn plumage, differs from the only other Colombian example that I have seen (No. 34095, U. S. Nat. Mus., ♂ ad., Sta. Marta), and also from descriptions, in having the entire breast barred with white, there being no uniform black band or space between the barred portion and the pure white chest; the upper parts are a *much* lighter and much duller brown, but this may be due to the worn condition of the plumage. It is also smaller, the Sta. Marta specimen measuring as follows: Length (skin), 6; wing, 2.75; tail, 2.20; exposed culmen, 0.70; bill from nostril, 0.52; depth at anterior end of nostril, 0.20; tarsus, 0.95."

*Thryothorus melanogaster.*

"Adult male (No. 908, Collection Museo Nacional de Costa Rica, Pozo Azul (Pirris), Costa Rica, Dec. 8, 1885, José C. Zeledon): Pileum dull sepia-brown, tinged with brighter brown; hind neck similar but brighter, passing into chestnut on back, scapulars, wing-coverts, rump (where lighter and brighter), and upper tail-coverts; the last, and the greater wing-coverts, very indistinctly (hardly perceptibly) barred with darker; remiges dusky, but the prevailing color of their exposed surface (edges) dull chestnut-brown, very indistinctly barred with dusky; tail clear chestnut, distinctly barred with black, the black bars averaging about 0.07 to 0.08 wide and considerably narrower than the interspaces, except an inner webs. Lores and a narrow, indistinct superciliary stripe, grayish white; upper half of ear-coverts dusky, lower portion white, streaked with grayish dusky. Chin, throat, and chest pure white, the last with a small dusky spot (consisting of parts of only two or three feathers each) near each side; \* breast, upper belly, and anterior portion of sides plain black, tinged posteriorly with grayish brown, the feathers light bluish gray basally; sides of breast tinged with chestnut; belly blackish, distinctly and regularly though narrowly barred with brownish white; under tail-coverts similar but bars

\* Perhaps abnormal markings, not found in other specimens.



more decidedly brownish; flanks transversely mottled or indistinctly barred with dusky and pale brownish; thighs plain, light brown on lower portion, upper part barred with dusky. Upper mandible black, edged with paler; lower mandible light bluish gray or plumbeous; iris brown; feet dusky; length (skin), 6.10; wing, 2.85; tail, 2.65; exposed culmen, 0.70; tarsus, 0.98."

No. 42808 (U. S. National Museum Collection, San Mateo, Costa Rica, April, 1866, J. Cooper), has the under surface dull rufous-brown shaded with dusky ash centrally and the bands are of a more rufous shade. Also the upper surface is somewhat duller rufous, the head differing very little from the back. The lower mandible is plumbeous.

*Oreothlypis gutturalis.*

Young (No. 2116, Collection Museo Nacional de Costa Rica, Volcan de Poás, July 27, 1888, A. Alfaro): Evidently a bird not long from the nest. Above a trifle paler gray than in the adult female, but with the black patch on the back just as well marked. Below, the throat and breast are buffy with a brownish shade (almost the clay-color of Bidgway's "Nomenclature of colors.") Rest of lower parts ashy grayish, paler, almost whitish, in the center of the belly.

*Dendroica vieilloti.*

A series of four birds from the Pacific side of Costa Rica (Punta Arenas) and eleven from the Atlantic side (Porto Limon) belonging to the *D. vieilloti* group, compared with examples of true *D. vieilloti* and specimens (including the types) of *D. bryanti* and *D. bryanti castaneiceps* have convinced me that the two latter are only subspecifically distinct from *vieilloti*. In both instances the Costa Rican birds seem to furnish the connecting link, although in most characters in both instances they seem to be nearer the northern forms *bryanti* and *castaneiceps* than to true *vieilloti*; to which last form they approach closest in the rich yellow edgings to the wings.

In the type of *D. bryanti* the lower parts with the exception of chin and throat are bright gamboge-yellow (not so bright as in true *vieilloti*), with a few narrow mostly concealed streaks of chestnut-rufous. In other specimens from the same locality the chestnut streaking is decided, but streaks narrow, and not merging into the rufous-chestnut of the throat, which has a sharply defined margin. In Costa Rican examples (from the Atlantic side) the chestnut stripes are much broader (but not so broad as in *vieilloti*) and the margin of the chestnut throat is not well defined, having a tendency to spread itself into the chestnut streaking of the breast, as in *vieilloti*. The shade of rufous-chestnut on the head and throat varies the same degree in the different specimens. There are ten adult males (*D. vieilloti bryanti*) from the Atlantic side; none

of these have the head as dark a chestnut as the birds from the Pacific side (five adult males, including the type of *castaneiceps*.) The type of *castaneiceps* differs from *bryanti*, as shown by Mr. Ridgway, only in the darker chestnut head; like the type of the latter, the jugulum and breast are marked with a few very indistinct and mostly concealed streaks of chestnut-rufous. These streaks in two birds from Mazatlan, Mexico, are very much better defined and broader; in No. 58252, U. S. National Museum, the chestnut throat is sharply defined, the color not extending onto the foreneck; in No. 35017 the chestnut of the throat is not so well defined, and extends more onto the foreneck. In the two Costa Rican examples (Nos. 55 and 2943, Museo Nacional de Costa Rica), the chestnut extends more onto the foreneck and has an ill-defined margin, while the streaks on the jugulum and breast are a trifle wider and brighter than in the Mazatlan examples; not so broad, however, as in birds from the Atlantic side. We may suppose from analogy, I think, that birds from Veragua would come another step nearer *vieilloti*.

With the material I have before me I believe the bird found on the Atlantic side from Mexico to Costa Rica should bear the name *Dendroica vieilloti bryanti* (Ridgway), as it was first separated by Mr. Ridgway; while the birds found on the Pacific side, from Lower California to Costa Rica, would become *Dendroica vieilloti castaneiceps* (Ridgway).

*Castaneiceps* is distinguished from *bryanti* by the darker rich chestnut head, and the stripes on the jugulum and breast usually narrower (in the type almost wanting) and less well defined.

*D. vieilloti* is distinguished from either of the preceding by the broad chestnut stripes on the under parts merging into the chestnut of the throat, which has no definite margin.

Two young males of *D. vieilloti bryanti* just assuming the adult phase are probably deserving of some notice. Their general coloring above is dusky olive-yellow, interspersed with many ashy-gray feathers, crown ashy, with an olive-yellow shading and many chestnut-rufous feathers, especially on the forehead; the edges of the wing are not so bright yellow as in the adult bird; the prevailing color below is cream-color, with here and there a few gamboge-yellow feathers with chestnut streaks, especially on the breast and jugulum. The throat in one is rufous-chestnut, as in the adult; while in the other it is ashy-whitish, with chestnut shading. The adult female has the head dusky olive-yellowish (like the back), strongly shaded with a yellowish rufous; below, the chin, throat, and sides of face are ochre-yellow, with a rufous shading; the remaining lower parts are as in the male, only the chestnut streaking is paler. A young female is olivaceous-ashy above; brighter olive on the rump, and deeper ash on the head. General color below cream-color, grayish along the sides, and the under tail-coverts pale yellowish.

*Geothlypis caninucha icterotis.*

With twenty examples, all from the vicinity of San José, Costa Rica, representing specimens taken in the months from April to December, and the types of *G. poliocephala*, *G. caninucha*, *G. caninucha icterotis*, and *G. palpebralis*, all before me, I thought for some time that I could select from the series of Costa Rican birds specimens that would exactly match any one of the four types; at the same time the gradation from one to the other in the series seemed so gradual as to make them inseparable. I felt convinced that Mr. Sharpe was correct when he placed *caninucha* as a synonym of *poliocephala* (Cat. Birds Brit. Mus., Vol. x, p. 359), but not as had already been pointed out by Mr. Ridgway (Manual of North American Birds, p. 526), that the two forms represent seasonal differences, because in my Costa Rican series, that which Mr. Sharpe would call the winter plumage is to be found in birds from May to August as well as December. The color differences are in my opinion due entirely to individual variation. And, on the other hand, to be convinced that relative measurements have little taxonomic value one has only to glance through the accompanying table of measurements taken from the series of Costa Rican birds.

The above were my hastily formed conclusions, part of which had to be changed on more careful examination of the material, as follows: The type of *poliocephala* is a trifle paler on the belly and anal region than the greater part of the specimens, but it is matched in this respect by at least four examples. The back is, however, a dusky olive-green, with very little indication of the brownish shading so conspicuous in the majority of Costa Rica specimens; and while in many Costa Rican birds there is some white on the eyelids, it does not extend around the eye as in *poliocephala*.

Mr. Ridgway separated the Costa Rican bird as *G. caninucha icterotis* (Proceedings U. S. National Museum, Vol. xi, p. 539), believing it to have olive-yellow or yellowish-olive auriculars, distinguishing it from the Guatemalan specimens. The series of Costa Rican examples presents much variation in the color of auriculars varying from an olive-gray (almost as dark as seen in the type of *caninucha*) to a yellowish olive, similar to the type of *caninucha icterotis*.\*

The specimens on which *poliocephala*, *palpebralis*, *caninucha*, and *caninucha icterotis* were based are, with the exception of the last, in very old, worn, and poor plumage, and I believe a good series from different localities would connect all as races of a single species.

*G. caninucha icterotis* is a common resident bird in the fields about San José, where it breeds abundantly. Its habits are similar to those of the Maryland Yellow-throat (*G. trichas*). It is quite shy and difficult to approach. Specimens are in best plumage from October to March.

\* I would here observe the type of *caninucha icterotis* seems to me to be one with unusually bright auriculars, while the type of *caninucha*, on the other hand, seems to have very dark auriculars. In other words, the birds chosen as types would seem to represent the extremes of color in the two forms.

*Measurements of specimens of Geothlypis caninucha icterotis* Ridgw.

No.	Collector.	Locality.	Date.	Sex.	Wing.	Tail.	Expos'd culmen.	Depth of bill at base.	Tarsus.
541	Geo. K. Cherrie.....	San José.....	Apr. 25, 1889	♀	2.08	2.50	0.45	0.20	0.86
575	do.....	do.....	May 11, 1889	♂	2.80	2.64	0.43	0.20	0.86
576	do.....	do.....	do.....	♂	2.14	2.55	0.43	0.21	0.86
610	do.....	do.....	June 2, 1889	♂	2.30	2.66	0.47	0.23	0.92
620	do.....	do.....	June 4, 1889	♂	2.24	2.67	0.47	0.18	0.88
623	do.....	do.....	June 7, 1889	♂	2.16	2.45	0.46	0.22	0.89
634	do.....	do.....	June 11, 1889	♂	2.06	2.59	0.44	0.18	0.87
639	do.....	do.....	June 16, 1889	♂	2.24	2.66	0.45	0.20	0.90
669	do.....	do.....	June 23, 1889	♂	2.25	2.70	0.44	0.20	0.84
702	do.....	do.....	July 9, 1889	♂	2.28	2.56	0.44	0.20	0.85
765	do.....	do.....	Aug. 5, 1889	♂	2.30	2.70	0.45	0.20	0.92
792	do.....	do.....	Aug. 21, 1889	♀	2.14	2.71	0.40	0.18	0.84
970	do.....	do.....	do.....	♂	2.18	2.44	0.43	0.18	0.90
971	C. F. Underwood.....	do.....	Oct. 15, 1889	♂	2.14	2.58	0.44	0.19	0.88
972	Geo. K. Cherrie.....	do.....	Nov. 6, 1889	♂	2.39	2.82	0.46	0.22	0.92
1024	do.....	do.....	Dec. 8, 1889	♂	2.29	2.66	0.44	0.18	0.84
1025	do.....	do.....	do.....	♀	2.10	2.59	0.45	0.19	0.88
1268	do.....	do.....	Feb. 5, 1890	♂	2.16	2.58	0.44	0.20	0.86
2027*	A. Alfaro.....	do.....	Aug. 15, 1887	♂	2.32	2.28	0.44	0.18	0.86
2028	do.....	do.....	do.....	♂ juv.	2.37	2.68	0.42	0.17	0.86

\* Museo Nacional de Costa Rica.

*Geothlypis bairdi*.

Four specimens compared with Mr. Nutting's three examples in the U. S. National Museum, from Los Sábalos, Nicaragua, are probably inseparable from that form; however, the under parts are brighter yellow and the yellowish olive-green of the sides does not encroach so far on the sides of the breast and the lower parts in general. In addition, in Mr. Nutting's specimens the under tail-coverts are almost exactly the color of the sides, while in mine they are much more yellowish.

The relative measurements, as shown below, are almost the same.

Number.	Collection.	Sex.	Wing.	Tail.	Cul- men.	Tarsus.	Depth of bill.	Middle toe with outclaw.
3555	Museo Nacional de Costa Rica.....	♀	2.18	2.10	0.53	0.82	0.20	0.60
4042	do.....	♂	2.28	2.00	0.54	0.87	0.20	0.60
1452	Geo. K. Cherrie collection.....	♂	2.38	2.25	0.56	0.89	0.22	0.61
1817	do.....	♂	2.34	2.17	0.60	0.85	0.21	0.60

## NUTTING'S TYPE SPECIMENS.

91151	U. S. National Museum.....	♂	2.28	2.10	0.56	0.80	0.20	.....
91150	do.....	♂	2.28	2.25	0.58	0.84	0.20	.....
91152	do.....	♀	2.17	2.10	0.54	0.84	.....	.....

*Basileuterus delatril*.

Two young specimens, both from the vicinity of San José, one in the collection of the U. S. National Museum, the other from the collection of the Museo Nacional de Costa Rica, differ from the adult, in being dusky brownish olive above, especially on the upper back and head; the lower back, rump, tail, and wings are more as in the adult. On the head there are no signs of the chestnut crown or white super-

ciliary of the adult; the entire head is dusky brownish olive; the lores are slightly darker; the chin and throat is dusky yellowish olive; the breast is the same color, with more brownish shading; the sides grayish olive; belly and crissum primrose yellow, with a few bright yellow feathers on the sides of the lower breast.

*B. delatirii* is an abundant resident, breeding commonly about San José. For notes on the nest and eggs see *The Auk* for October, 1891.

*Basileuterus melanogenys.*

Young, (No. 30498, U. S. National Museum, Costa Rica): General color above brownish olive, more olivaceous on edges of wing and tail; wing-coverts brownish black edged on outer webs with olive-brownish and tipped with ochraceous-buff, forming two wing-bars. A few chestnut feathers in the center of the crown and a few feathers indicating the black margin to the crown; there is a broad buffy white supra-auricular stripe extending from just above the eye to the nape; the sides of the head are blackish; ear-coverts, chin, and throat are indescribable brownish buffy; breast and chest brownish, with an olive shade, sides darker, center of belly whitish.

*Setophaga aurantiaca.*

A single specimen from the collection of the Costa Rica National Museum is bright orange-yellow below, decidedly brighter than any of the examples in the U. S. National Museum collection, including the type.

*Vireo pallens.*

A single example of this rare vireo taken at Punta Arenas, Costa Rica, (No. 2946, ♀, Museo Nacional de Costa Rica, March 6, 1889, Alfaro and Cherrie), agrees very closely with one of Mr. Salvin's types of the species (that described by Professor Baird in his Review), No. 33601, U. S. National Museum. The upper parts are slightly brighter dull grayish olive, the edges of the quills and tail-feathers are also slightly brighter, the two white bands on the wings are well developed. Beneath there is more of a buffy shade than in the type, and the tibiae are dusky blackish, not "ashy." The specimen is not in very good condition, and it is hard to make out the characters about the head; but there is a whitish line from the bill and extending above the eye; the lores are dusky, while the front edge of the eyelids is black; the auriculars are darker, more dusky than in the type; the bill is horn color, the feet dusky, and the iris white. It measures length (skin), 4.20; wing, 2.22; tail, 2.06; gony, 0.28; depth of bill at base, 0.16; width at nostrils, 0.18; tarsus, 0.76; middle toe and claw, 0.58 (the tip of the upper mandible is broken away). The specimen was taken among the mangroves back of the town, probably in about the same sort of locality as the type.

*Hylophilus ochraceiceps.*

A single Guatemalan skin, two from Segovia River, Honduras, three from Costa Rica, and one from Veragua (Chiriqui) all differ from the type from Mexico in being paler below, very few showing the yellowish-brown color of the breast, and almost all with more olive shading on the sides. Above there is more olive shading on the lower back and rump, and the same color is more noticeable on the hind neck. All have the edges of the tail-feathers lighter brown, and basally a perceptible shading of olive not seen in the type; besides, they are slightly smaller in wing and tail measurements.

*Cyclorhis flavipectus subflavescens.*

After a study of the literature on the subject and a careful comparison of a small series of Costa Rican specimens with the different forms of *Cyclorhis* in the U. S. National Museum, including the types of *flavipectus* and *flaviventris yucatanensis*, I am convinced there is only one species found in Costa Rica, and that is *subflavescens*. The Costa Rican bird, *subflavescens*, is separable readily from *flaviventris* or *flaviventris yucatanensis* by the white on the belly, which, even in those specimens with the greatest amount of yellow on the under surface, is distinct. This character is enough to distinguish them, but the Costa Rica bird is decidedly and uniformly brighter olive-green above.

Unfortunately the number of specimens of *flaripectus* is limited to four, two of which are referable to Professor Allen's *flaripectus trinitatis*. I have fifteen Costa Rican specimens. All agree in having the auriculars dark ash-gray, while in *flaripectus* they are pale ash. In addition, the rufous-chestnut superciliary stripe in the Costa Rican examples appears darker and is shorter, not extending to the nape. There are also the differences pointed out by Mr. Allen (Bull. Am. Mus. Nat. Hist., Vol. II, No. 3, p. 131).

*Vireolanus puchellus verticalis.*

Costa Rica examples compared with the type (also from Costa Rica) agree minutely.

*Diglossa plumbea.*

Young birds are brownish olive above, dusky brownish below, with buffy brownish in the center of the belly.

*Dacnis venusta.*

Young males probably resemble the females. A young male (No. 773, Museo Nacional de Costa Rica), just assuming adult plumage, has the forehead black like the adult male, and bright blue feathers are scattered in the dusky greenish of the crown. There are a few black feathers in the upper back. The scapulars, lower back, and rump are blue; part of the wing-coverts, quills, and tail-feathers black, and part

dusky, as in the female. Below the throat is black, while there are scattering black feathers over the ashy and ochraceous-buffy of the remaining lower parts.

*Euphonia gracilis.*

Four female examples of a *Euphonia*, collected in Pozo Azul (Pirris), Costa Rica, in December, 1888, by Mr. J. C. Zeledon, and labeled by that gentleman *Euphonia gracilis*, may be described as follows: Above olive-green with a strong bronzy-green sheen, more yellowish and less bronzy on the rump and upper tail-coverts; forehead and front part of crown rufous-chestnut; wings and tail blackish, with yellowish olive edges. Below greenish olive, yellowish on chin and throat; center of breast and belly tawny ochraceous, under tail-coverts yellowish orange-ochraceous, axillaries yellow.

This description differs markedly from any hitherto published, and I hesitated long before giving it. But in examining a number of young male birds (with only a little yellow on the forehead) that appeared to belong to either *gracilis* or *luteicapilla*, I endeavored to find a character that would separate the species at all ages. In examining the specimens I noted that in *gracilis* the dusky or black at the bases of the yellow feathers of the crown always extends farther along the shaft of the feather than along the web, making a V-shaped union between the yellow tip and darker base. This is most marked on the feathers farthest back on the crown, but is noticeable even on those on the extreme forehead. In *luteicapilla* the yellow tip joins the dusky base in a straight line across the feather. Usually, also, the yellow in *gracilis* is paler, confined more to the extreme tip of the feather, and the dusky base is blacker. This being noted, I found that all the young specimens pertained to *luteicapilla*. Then came Mr. Zeledon's specimens labeled *gracilis*. An examination of so-called females of *gracilis* and *luteicapilla*, and of published descriptions, seemed to point to their being indeterminable one from the other. It might here also be observed that in *gracilis* the bill is heavier and the gonyes decidedly more convex than in *luteicapilla*.

The Zeledon birds, or female *gracilis*, are very distinct from *E. gouldi*; and while there is rather a close color resemblance to the females of *fulvicrissa*, the size is much greater, being equal to the males of *gracilis*. Males of *gracilis*, compared with those of *fulvicrissa*, are seen to have the same style of crown (the V-shaped union between the black base and yellow tip). All males of *fulvicrissa* examined have a white spot on the inner web of the outer tail-feathers, sometimes well defined and again only faintly indicated. Four out of the six males of *gracilis* have the white mark on the outer tail-feather.

I do not know what Mr. Zeledon's reasons were for identifying his specimens as *gracilis*, but he gave special attention to the *Euphonia*, and took both male and female in the same locality and at the same time.

Since returning to Costa Rica I have examined the Museo Nacional series of thirty *luteicapilla* and *gracilis*, including three additional females of *gracilis*, and am thoroughly convinced that female of *gracilis* has hitherto been unknown or confounded with some other form.

*Euphonia minuta*.

Seven adult males from Costa Rica compared with a single male (adult) from Sarayacu, Ecuador, are shaded with deeper orange on the yellow of the lower parts and forehead, while the Ecuador bird has the bill just appreciably larger.

*Ramphocelus costaricensis*.

In looking over the specimens of *R. passerinii* in the U. S. National Museum collection, I find a very good example of my recently described *R. costaricensis* (The Auk, January, 1891, p. 62). The specimen (No. 42863, U. S. National Museum collection, Navarro, Costa Rica, January, 1886, J. Cooper) agrees, as far as my memory serves me (having no examples at hand for comparison), with my type, being perhaps a trifle brighter on the breast, and the wings and tail more dusky brownish, or more like those of *passerinii*. The specimen was originally marked female (♀), but some one, at a later date, and with ink that has not yet faded, has drawn a line across this and written below "Juv. ♂."

Since returning to Costa Rica the Museo Nacional has received eight additional examples of this new form.

*Chlorospingus pileatus*.

I have two young birds in plumage hitherto undescribed. No. 5416, Museo Nacional de Costa Rica, Volcan de Irazú, April 23, 1891, is evidently just from the nest, as there is yet in the plumage some of the nestling down. Above it is light olive-brownish, wings and tail blackish, the latter with dull olive-yellowish edges; prevailing color of wing-coverts like the edges of the quills. Head black, crown bordered with a broad white stripe extending from just in front of the eye to the nape. Lores, supraocular stripe, and auriculars black. Below prevailing color grayish olive-buff, lightest in the center, with ill-defined blackish or dusky streaks; sides more uniform olive; chin, throat, and cheeks ashy whitish; bend of wing whitish. No. 3095, ♂ juv., Volcan de Poás, July 5, 1889, A. Alfaro, is a much older bird. Above brownish olive-green, wings and tail dusky, edged with the color of the back, slightly the brighter on the primaries; head black; many yellowish feathers in the whitish stripe on the sides of the crown. Below cheeks, throat, and breast olive-yellowish, with indistinct dusky striations; an indistinct dusky line along the sides of the throat, joining the auriculars posteriorly; sides, belly, and crissum dusky or brownish olive-greenish.



*Buarremon gutturalis.*

Guatemalan birds, compared with Costa Rican specimens, seem a trifle larger, especially a longer tail, and the yellow of the throat appears to extend farther down on the fore breast. However, the Guatemala skins are so lengthened in the making up it is difficult to judge.

*Dendroornis nana costaricensis* Ridgw.

An examination of a series of Costa Rican specimens compared with examples from Panama, including the types of *nana*, Lawrence (= *lawrencei* Ridgw.), kindly sent me for examination by Professor Allen of the American Museum of New York, are uniformly the larger (especially the bill), and certainly seem to me separable as a distinct race, although Mr. Elliot (*The Auk*, VII, 1890, pp. 174, 175) contends they are the same, remarking that "the slight difference in size to be noticed in a series of any species of this genus is evidently of no specific value." It may be very true that there is as great individual variation in the different species as between average Costa Rica birds and average Panama birds. But the smallest Costa Rican bird is slightly larger than the Panama birds (I must except a single evidently young bird), while the largest Costa Rica bird has the bill just 0.46 of an inch longer than the largest Panama example.

As to the distinctness of *nana* and *lawrencei* a comparison of the two type specimens shows them to be identical; an opinion in which Mr. Ridgway concurs, thus fully agreeing with Mr. Elliot. It should, however, be stated that in Mr. Lawrence's type of *nana* the tail feathers are not fully grown, being only 3.10 inches long, while in the bird on which Mr. Ridgway based his *lawrencei* the tail measured 4.36. There is a similar but lesser difference in the wings, measuring 3.60 and 4. Mr. Ridgway's example is in very perfect plumage, while the other is in a state of change. Mr. Ridgway says he was misled by the original measurements given in the description of *nana*. He did not have the bird for examination.

The uniting of *nana* and *lawrencei* changes the name of the Costa Rica bird from *lawrencei costaricensis* to *nana costaricensis*, as I have written it above.

The Costa Rican bird appears to reach its maximum development on the west coast.

*Myrmeciza stictoptera* Lawr.\*

A single male specimen of this exceedingly rare bird, No. 2335, Museo Nacional de Costa Rica, San Carlos, Costa Rica, December 25, 1888, A. Alfaro, compared with Mr. Lawrence's type, No. 34777, U. S. National Museum, Angostura, Costa Rica, agrees minutely with that bird. It is certainly a very distinct species, differing decidedly from *M. exsul* and its allies in having a concealed white dorsal patch, and from *M. lamas-ticta* in having the throat unspotted. Yet Mr. Selater, in Vol. xv, Cata-

\* See Ann. Lyc. N. H. of N. Y., vol. VIII, p. 132.

logue of Birds in the British Museum, in treating of the genus *Myrmeciza*, does not mention *stictoptera* even in his synonymy.

*Picolaptes compressus* (Sol.)

An examination of a series of thirty-three specimens taken from various points and altitudes on both the Atlantic and Pacific sides of the high interior of Costa Rica shows much individual variation in size and color; variations that seem to connect (very closely indeed) *compressus* with *gracilis*. I have not, unfortunately, the type of *gracilis* before me, but have carefully studied Mr. Ridgway's original description (Proc. U. S. National Museum, Vol. XI, p. 542) and also Mr. Sclater's notes, taken from the type (Cat. Birds British Museum, xv, p. 154). From the appended table of measurements it will be seen that the variations in size are from: wing, 3.93 to 3.40; tail, 3.96 to 3.43; from nostril to tip of bill, 1 to 0.70; tarsus, 0.71 to 0.65. In arranging the table I separated the birds into four groups; the first from the central west coast region (Gulf de Nicoya). These prove to be slightly the largest and are as a whole a lighter brown (sepia) below; the paler markings vary from deep buff to buffy-whitish, the feathers of the throat usually narrowly bordered with blackish. Above there is no appreciable difference in color from birds from other localities.

The second group comes from the east side of the Cordillera, in nearly the same latitude as the first group and at an elevation of about 2,500 feet. The bill averages slightly smaller and darker horn-color. The coloration above and below is not to be distinguished from that of birds belonging to the first group. It will be noted that the two lots were taken at the same season.

The third group comes from the southwest coast region. They are intermediate in size, although slight the difference, between the first and second groups; they average slightly darker below, more of a bistre than a sepia brown. The bill is about as dark as in birds of the second group.

The fourth group is from the eastern side about the same latitude as the last. The birds of this group average decidedly the smallest; there are, however, only four of them. No. 5437, Museo Nacional de Costa Rica, is especially small. Above and below the brown is of a darker shade. The upper mandible is blackish, the lower horn-color for at least the basal half, the interior half being broken away.

The birds in the third group, from Pozo Azul, are from the same geographical region as the type of *gracilis* (Monte Redondo), but certainly can not be separated from other examples of *compressus*. I think anyone with my series of birds before them, and with only the descriptions of *compressus* and *gracilis* to guide them, would conclude that the color-differences were very slight, and that the relative measurements were hardly trustworthy characters.\*

The type of *gracilis* seems to have an unusually long tarsus.

\* See these Proceedings, vol. xiv, p. 475.

*Measurements of specimens of Picolaptes compressus.*

No. and sex.	Collector.	Locality.	Date.	Wing.	Tail.	Bill from nostril.	Tarsus.
2965 ♂	Alfaro and Cherrie	Majica	Mar. 13, 1889	3.92	3.83	0.98	0.71
4157 ♂	C. F. Underwood	Belvedere	Feb. 13, 1890	3.67	3.78	0.88	0.69
4158 ♂	do	do	Feb. 17, 1890	3.57	3.78	0.93	0.72
4159 ♂	do	do	Feb. 18, 1890	3.70	3.64	1.00	0.75
4160 ♂	do	do	Jan. 23, 1890	3.93	3.91	0.97	0.71
4161 ♂	do	do	Feb. 13, 1890	3.84	3.84	0.99	0.70
4162 ♂	do	do	Jan. 23, 1890	3.37	3.47	0.92	0.70
4493 ♂	do	do	Jan. 28, 1890	3.63	3.38	0.90	0.67
4494 ♂	do	do	Jan. 28, 1890	3.93	3.96	0.95	0.71
4495 ♂	do	do	Jan. 23, 1890	3.80	3.86	0.88	0.70
4496 ♂	do	do	Feb. 18, 1890	3.53	3.54	0.97	0.69
4497 ♂	do	do	Feb. 21, 1890	3.55	3.55	0.90	0.70
4499 ♂	Anastasio Alfaro	do	Jan. 24, 1890	3.40	3.49	0.92	0.70
4937 ♂	do	San Lucas	Feb. 14, 1890	3.68	3.54	0.86	0.70
5426 ♂	C. F. Underwood	Guayabal	Feb. 19, 1891	3.58	3.55	0.85	0.70
5427 ♂	do	do	Feb. 16, 1891	3.50	3.64	0.84	0.70
5428 ♂	do	do	Feb. 13, 1891	3.85	3.77	0.83	0.68
5429 ♂	do	do	Feb. 16, 1891	3.48	3.70	0.83	0.67
5430 ♂	do	do	Feb. 18, 1891	3.66	3.83	0.87	0.65
5431 ♂	do	do	Feb. 25, 1891	3.51	3.67	0.86	0.68
5432 ♂	do	do	Feb. 17, 1891	3.70	3.62	0.80	0.70
5439 ♂	do	do	Feb. 14, 1891	3.58	3.82	0.84	0.70
5440 ♂	do	do	Feb. 17, 1891	3.37	3.43	0.80	0.70
3321		Pozo Azul	Sept. 13, 1889	3.58	3.58	0.80	0.70
3322		do	Sept. 13, 1889	3.67	3.77	0.93	0.70
3323		do	Sept. 13, 1889	3.72	3.64	0.82	0.71
5433 ♂	C. F. Underwood	do	May 2, 1891	3.73	3.73	0.90	0.70
5434 ♂	do	do	May 12, 1891	3.46	3.53	0.85	0.70
5435 ♂	do	do	May 10, 1891	3.65	3.57	0.80	0.71
5425 ♂	A. Alfaro	Jiménez	Aug. 5, 1889	3.59	3.56	0.85	0.68
5436 ♂	do	do	Mar. 29, 1891	3.84	3.67	0.90	0.70
5437 ♂	Dr. C. L. King	Talamanca	Sept. 20, 1890	3.38	3.48	0.70	0.68
5441 ♂	R. Alfaro and Caranza	do	Feb. 21, 1891	3.44	3.44	0.83	0.67

*Philydor virgatus* Lawr.

A single specimen, No. 2332, collection of the Museo Nacional de Costa Rica (San Carlos, Costa Rica, December 22, 1888, A. Alfaro), agrees exactly with the type.

*Grallaria intermedia*.

A single specimen (No. 629, ♂, Museo Nacional de Costa Rica, Jiménez, April, 1886, A. Alfaro) agrees exactly with Mr. Ridgway's type. As stated by Mr. Ridgway (Proc. U. S. National Museum, VI, p. 406), *intermedia* "represents a very distinct form," readily distinguished by the lighter ochraceous of the breast, sides, flanks, and crissum; by the broad black striations on the breast; a distinct black rectal stripe, and rufous tips to the wing-coverts. From *perspicillata* it is easily distinguished by the lack of black streaks on the flanks.

*Grallaria dives*.

A young bird of this species has the head and back much darker than in adults, and a few feathers, evidently of the first downy plumage, are dusky chestnut. The wing-coverts are faintly tipped with the same color. Below, the white of the middle of the belly and the throat is strongly washed with ochraceous.

*Ornithion imberbe*?

I brought a specimen with me that probably pertained to this species; but unfortunately while at the American Museum in New York it was carried away by a rat before I had opportunity to identify it.

*Tyranniscus parvus*.

Costa Rican specimens are intermediate in size between true *parvus* and *villissimus*; they are also more yellowish below than *parvus* from Panama. However, the relationship throughout seems the closer to *parvus*.

*Empidonax albigularis*.

I have a specimen that certainly does not agree very closely with Mr. Selater's description (Cat. Birds Brit. Mus., XIV, p. 223); however, compared with examples in the Smithsonian collection that differ in the same way, but which have been identified as *E. albigularis* by Mr. Selater, it is found that they agree.

*Contopus lugubris*.

A female in freshly assumes plumage, is much richer colored than any of the three examples, including the type, in the Smithsonian collection. Above and below it is much more of an olive. In size it is also a trifle smaller. The specimens in the Smithsonian collection are all in much worn plumage.

*Platypsaris aglaiae* (Lafr.).\*

A single female, taken at Jiménez, in tierra caliente, on the Atlantic side of Costa Rica.

*Pachyrhamphus versicolor*.

A fine male, taken at La Palma de San José, Costa Rica.

*Pipra velutina* Berl.

Male Costa Rican specimen from Pozo Azul agree closely with Panama examples, but have a greenish shading on the rump and upper tail-coverts, and also below on the center of the belly, and decidedly developed on the under tail-coverts. This may, however, be a character of the young.

A female is parrot-green above, slightly brighter on the head and duller on the rump. There are three or four blue feathers in the crown. Below the breast is duller green, the throat greenish gray; the sides are paler, while the center of the belly and the crissum are greenish yellow.

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\*Doubtless *P. a. obscura* Ridgw., recently described in these "Proceedings" (page 474).

The parrot-green color of the back readily distinguishes the females of this species from all others of the genus except *cyaneocapilla* and *suavissima*. The latter is distinguished by the lemon-yellowish belly.

*Pipra leucorrhoa*.

Females are bright olive or greenish above; below duller, grayish, or with a grayish shading on the throat, and yellowish on the belly. The axillaries are white or pale yellowish. Young males resemble females but have the throat white.

*Pipra leucocilla*.

Females are bright olive-green above; entire head and nape slate-gray, with perhaps an olive shading; below duller, throat with grayish, crissum and belly with whitish or pale yellowish. Bill much larger than in *leucorrhoa*.

*Pipra mentalis*.

Females are dull olive-green above (almost the color so named in Ridgway's Nomenclature); below, more yellowish-olive on throat and breast; abdomen and crissum yellowish; axillaries pale yellowish, inner edges of quills edged with whitish.

*Trogon elegans*, Gould.

Four specimens were forwarded from Costa Rica for identification. Mr. Ridgway has classified the birds as *T. elegans*, Gould, thus making the tenth representative of the Trogonidæ found in Costa Rica. The first of these specimens was secured by Alfaro and Cherrie on the small island of San Lucas, in the mouth of the Gulf of Nicoya, in March, 1889. Mr. Alfaro has since secured a fair series of specimens from the same locality. This I believe extends the southern range of the species.

*Antrostomus vociferus* (Wils.).

A single specimen taken at San José (No. 2823, ♀, Museo Nacional de Costa Rica, San José, Feb. 24, 1889, Geo. K. Cherrie), and identified by Mr. Ridgway, proved to be this species, thus extending its southern range and adding another species to the list of Costa Rican birds.

*Coccygus minor* (Gm.).

This bird is found on both coasts of Costa Rica, and in the interior to an altitude of about 6,000 feet.

*Chloronerpes simplex*.

A single male from the Pacific side of Costa Rica (Pozo Azul), compared with an example from the Atlantic side, is decidedly smaller, and there are some color differences; however, with only the two examples before me I am not sure but that the variation is entirely individual.

**Melanerpes chrysauchen, Salv.**

(No. 3339, ♀, Museo Nacional de Costa Rica, Pozo Azul, Sept. 9, 1889, J. C. Zeledon). Mr. Ridgway identifies the above specimen as *chrysauchen*, adding another to the list of Costa Rican birds and extending the known northern range of the species.

**Accipiter tinus (Lath).**

Señor Don Anastasio Alfaro secured a very fine male specimen of this beautiful little hawk near Greytown, Nicaragua.



# SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COMMISSION STEAMER ALBATROSS.

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No. XXII.—DESCRIPTIONS OF THIRTY-FOUR NEW SPECIES OF FISHES  
COLLECTED IN 1888 AND 1889, PRINCIPALLY AMONG THE SANTA  
BARBARA ISLANDS AND IN THE GULF OF CALIFORNIA.

BY  
CHARLES H. GILBERT.

The following forms are here described as new :

- |  |                                       |
|--|---------------------------------------|
| 1. <i>Raia trachura</i> .                                      | 18. <i>Pomacentrus leucorus</i> .     |
| 2. <i>Catulus xaniurus</i> .                                   | 19. <i>Gobius microdon</i> .          |
| 3. <i>Catulus cephalus</i> .                                   | 20. <i>Bollmannia ocellata</i> .      |
| 4. <i>Catulus brunneus</i> .                                   | 21. <i>Bollmannia macropoma</i> .     |
| 5. <i>Eulamia</i> ( <i>Platypodon</i> ) <i>platyrhynchus</i> . | 22. <i>Bollmannia stigmatura</i> .    |
| 6. <i>Stolephorus cultratus</i> .                              | 23. <i>Gobiosoma crescentalis</i> .   |
| 7. <i>Myctophum regale</i> .                                   | <i>Chriolepis</i> , gen. nov.         |
| 8. <i>Alepocephalus tenebrosus</i> .                           | 24. <i>Chriolepis minutillus</i> .    |
| 9. <i>Porogadus promelas</i> .                                 | 25. <i>Gillellus ornatus</i> .        |
| 10. <i>Siphostoma carinatum</i> .                              | 26. <i>Prionotus gymnostethus</i> .   |
| 11. <i>Callechelys peninsulæ</i> .                             | 27. <i>Careproctus melanurus</i> .    |
| 12. <i>Atherinops insularum</i> .                              | 28. <i>Paraliparis cephalus</i> .     |
| 13. <i>Mugil setosus</i> .                                     | 29. <i>Paraliparis mento</i> .        |
| 14. <i>Diplectrum sciurus</i> .                                | 30. <i>Trachyrhynchus helolepis</i> . |
| 15. <i>Mycteroperca pardalis</i> .                             | 31. <i>Macrurus pectoralis</i> .      |
| 16. <i>Bodianus acanthistius</i> .                             | 32. <i>Lycodes diapterus</i> .        |
| 17. <i>Upeneus xanthogrammus</i> .                             | 33. <i>Symphurus fasciolaris</i> .    |
|  | 34. <i>Antennarius reticularis</i> .  |

## 1. *Raia trachura* sp. nov.

This species is most nearly related to *Raia isotrachys*, but the disk is broader, with the snout much blunter, the angle of latter much greater than a right angle.

Top of disk sparsely but evenly covered with small sharp prickles with stellate base, which become crowded on interorbital space, in a broad band along anterior margin of disk, on middle of disk behind shoulders, and especially on sides of tail. No spines on orbital rim or shoulders. A single small spine on middle of back between shoulders, heavier but not longer than the prickles. A series of strong spines on middle of tail, 23 in number, diminishing in size posteriorly.



Outer pectoral angles broadly rounded, placed more anteriorly than in *isotrachys*. Anterior outline strongly undulated, very convex near tip of snout, which projects slightly beyond the profile. Snout very broad, its anterior angle about 120 degrees. Length of disk (to opposite posterior insertion of pectorals)  $1\frac{1}{2}$  in its width. Interorbital space concave,  $1\frac{1}{2}$  times longitudinal diameter of eye, which is contained  $3\frac{1}{2}$  times in snout. Distance from front of eye to nearest point on margin of disk  $1\frac{1}{2}$  in length of snout (less than half snout in *isotrachys*).

Teeth very small, each with a single minute cusp directed backwards eight oblique series in each half of upper jaw.

Distance between gill openings of first pair, one-third length of disk including the ventrals. Tail longer than body by half length of snout. Dorsal fins small, of about equal size, covered with prickles. Base of ventrals smooth above, a few prickles on distal half.

Uniform plum-color above, slightly darker at margin of disk. Below brown, lighter on body, becoming blackish on lateral margins of pectorals and ventrals.

A single specimen, 18 inches long, from station 2923, in 822 fathoms.

## 2. *Catulus xaniurus* sp. nov.

Snout short and broadly rounded, much as in *Catulus canescens* Günther, the distance from snout to front of mouth one-half greatest width of snout, the latter equaling width of mouth. Nostril valves separate the width of isthmus nearly half width of nostrils, the valve with short cirrus. Distance from inner edge of nostrils to mouth one-third their distance from tip of snout. Lips with a well-developed fold around angle of mouth, that on lower jaw extending two-sevenths one-fourth distance to symphysis, the fold on upper lip about half as long as that on lower.

Teeth small, acute, about five series functional in each jaw. Teeth similar in both jaws, the median and the extreme lateral teeth much reduced, those along greater extent of jaw with a prominent median cusp, and two small lateral ones on each side. Towards angles of jaws, the median cusps become much smaller and are little larger than the lateral ones.

Snout and sides of head soft, with numerous mucous pores, those on lower side of snout in an oval patch. Eyes large, their horizontal diameter more than half the interorbital width, or than distance from tip of snout to their front margins.

Anterior gill slit separated slightly more than the posterior ones, the distance between them equaling length of slit. Last two gill slits above the base of pectorals.

Pectoral small, not notched, its angles rounded, a wide strip along its upper posterior border devoid of prickles. Length of its anterior border equaling that of snout and eye. Posterior margin of ventrals very oblique. In one young male, 30 centimetres long, the claspers

are small and undeveloped, not extending backwards as far as posterior ends of ventrals; in another, 38 centimeters long, they are fully developed, and extend backwards as far as origin of anal.

First dorsal over the ventrals, its base shorter than that of the anal, contained twice in the interspace between dorsals. Its posterior insertion is vertically above that of the ventrals. Second dorsal slightly shorter and lower than the first, its base wholly above that of the anal, which overlaps it in front and behind. Base of second dorsal  $1\frac{1}{2}$  in that of anal. Base of anal twice the space separating it from lower lobe of caudal, and about equaling its distance from ventrals. Height of first dorsal (measured along longest rays) equals distance from tip of snout to front of pupil.

Caudal not deeply notched, its length equaling distance from tip of snout to fourth or fifth gill slit, and contained  $4\frac{1}{2}$  in total length.

Head, body, and fins covered with small triangular prickles, with broad base and usually a single backwardly directed point. They are rather sparsely distributed, except on end of snout and along margins of fins, especially along upper edge of caudal, where they are closely crowded to form a dense rough band. These caudal plates are broad and densely overlapping, each with three equal cusps. This approximates the arrangement characteristic of *Pristiurus*, between which and *Catulus* this species forms a partial transition. In young specimens 5 to 6 inches long, the band of enlarged prickles on back of caudal has not yet developed.

Color dark slaty-brown, uniform on head body and fins, the latter without appreciably lighter margins in some specimens, in others broadly or narrowly margined with white, or with spots or large irregular areas of whitish. One specimen shows small white spots on dorsal region.

Described largely from a female specimen, 23 inches long, with well-developed eggs. The egg cases are narrow and flattened, one-third as wide as long, becoming much more narrowed at the posterior than at the anterior end.

Very abundant in deep water off the coast of Southern and Lower California, specimens being taken at stations 2891, 2892, 2896, 2903, 2948, and 3045, in depths ranging from 184 to 684 fathoms.

### 3. *Catulus cephalus* sp. nov.

A number of small specimens, dredged in deep water near the Revillagigedo Islands and in the Gulf of California, strongly resemble *Catulus xaniurus*, but differ constantly in the following respects:

The head appears much wider and the snout is shorter, the length of preoral portion being less than one-half its greatest width.

The fins are different in relative size and position, the dorsals being larger, the second dorsal more posteriorly inserted, and the anal smaller. The second dorsal is thus about equal to the anal in size, and terminates slightly behind it,

The pores on head are of larger size than in *xaniurus*, and are regularly arranged in series instead of in patches.

The coloration is darker, the lower portion being uniformly brown like the upper, instead of much paler.

None of our specimens show any trace of the band of rough plates on back of tail characteristic of *xaniurus*, and developed in the young of the latter of even smaller size. The adult of *cephalus* may or may not agree with *xaniurus* in this respect.

The teeth have mostly three cusps, the inner one often with a fourth one at the base, a fifth sometimes present on the outer side.

A specimen 24 centimetres long, from station 2992, is a young male, and shows the claspers very fully developed, reaching the base of the anal fin. This specimen is apparently nearly sexually mature, while in specimens of *xaniurus* of even larger size, the claspers are much less developed.

In the position of the second dorsal this species agrees with *Scyllium canescens* Günther, but differs in the much more anterior insertion of the first dorsal, which terminates above the ventrals instead of behind them.

Several small specimens from station 3007 (362 fathoms), in the Gulf of California, and a larger specimen from station 2992, at a depth of 460 fathoms.

#### 4. *Catulus brunneus* sp. nov.

Body deeper, the head narrower, the snout longer and sharper than in *Catulus xaniurus*. Length of snout before mouth three-fourths greatest width of snout and seven-eighths width of mouth. Nostrils large, the flap with a broadly rounded lobe, the inner ends of nostrils separated by a space equaling three-fourths length of nostril. Distance from inner end of nostril slits to mouth slightly less than one-third their distance from tip of snout.

Angle of mouth with a well-developed labial fold, that of lower lip slightly shorter than that of upper, and extending half way to symphysis.

Teeth similar in both jaws, with two or three rows functional in the upper jaw and four or five in the lower. Median cusp of teeth long, sharp, and strongly curved backwards and outwards. A single basal cusp on each side, the inner cusp having frequently a smaller one at base.

Diameter of orbit about one-third snout, the spiracle separated from it by nearly one-third its length.

Gill openings of moderate width, the last two over base of pectorals as usual.

Pectorals more extensively connate with body than usual, the angles rounded, but the posterior margin nearly straight. Length of their upper margin one-half distance from snout to third gill slit.

First dorsal small, narrow, and high, extending but little beyond ventrals. The length of its base is contained  $1\frac{1}{2}$  times in the interspace between dorsals. Second dorsal slightly larger than first and extending a little beyond the base of anal. When depressed it reaches beyond origin of caudal.

Anal very long, a short grooved channel behind ventrals reaching its base, as do also the tips of the ventrals themselves. The length of its base is  $2\frac{1}{2}$  times that of first dorsal, and the basal portion of fin is continuous with the fold which rises to form the lower caudal lobe. Caudal fin  $3\frac{3}{4}$  in total length, its terminal lobe but little more than one-sixth its length.

Head, body, and fins uniformly covered with minute close-set plates, each of which is triangular and furnished with three subequal spinous points. These are wanting on the posterior third of the upper face of the pectoral, and on the free edges of all the fins. No modified plates on the upper edge of the caudal.

Color uniform warm brown above and below, the snout and the margins of the fins blackish.

The only specimen secured is a female 50 centimetres long, and contains a pair of fully developed eggs, the cases showing a peculiar constriction towards each end.

##### 5. *Eulamia* (Platypodon) platyrhynchus sp. nov.

*Carcharias* sp. incog. Jordan and Gilbert, Procs. U. S. Nat. Mus., 1882, 107 (description of jaw only).

*Eulamia laniella* Jordan and Bollman, Procs. U. S. Nat. Mus. (not of Jordan and Gilbert).

Snout very flat and broadly rounded, of moderate length, its preoral portion slightly longer than width of mouth, and less than width of snout opposite nostrils. Middle of nostrils midway between front of mouth and tip of snout. Nostril flap without sharp lobe. No labial folds, the angle of mouth with two short creases.

Teeth in upper jaw broadly triangular and coarsely serrate, the inner edge oblique, the outer definitely notched in most cases, merely concave in others, the two kinds found together in the same jaw. The serræ are coarsest below notch on outer side of tooth. Lower teeth narrow, erect, serrulate.

Eye moderate, three-fourth width of gill-openings. Interorbital width greater than length of snout in front of eye by a distance equaling the diameter of the orbit.

Pectorals but little falcate, long, reaching beyond the base of first dorsal. The inner margin is two-sevenths length of the outer, and the greatest width is half the length.

First dorsal inserted close behind pectorals, its distance from root of pectorals two-fifth its base, the fin much nearer pectorals than ventrals. Its base is two-fifths the length of interspace between dorsals, and is less than its height, which is less than the depth of body.

Second dorsal inserted over the anal, its base one-third that of first dorsal, and less than one-half its distance from base of upper caudal lobe. Its upper margin is much less concave than that of anal, and the fin is smaller.

Lower caudal lobe nearly half the upper, which is  $3\frac{1}{2}$  in total length.

Light gray above, whitish below, the fins conspicuously margined with white in the largest specimen obtained, without margins in the others.

This species is very abundant at the Revillagigedo Islands, specimens being secured at Clarion and Socorro. A single individual was also obtained at Magdalena Bay, Lower California. It reaches a length of at least 8 feet. This is the species recorded by Jordan and Bollman from the Galapagos Islands as *Eulamia lamiella*. From *lamiella* it differs in the notched teeth and the anterior position of the first dorsal.

#### 6. *Stolephorus cultratus* sp. nov.

Body compressed, of medium depth, the abdomen compressed to an edge both in front of and behind the ventral fins, but without serrations. Behind the ventrals the edge is sharply carinate.

Head slender and sharp, the snout long and compressed, extending beyond tip of lower jaw for a distance nearly equaling diameter of orbit. Maxillary abruptly widened behind angle of mouth, then tapering to a rather sharp point which extends beyond mandibular articulation nearly to gill-opening.

Teeth in lower jaw small but distinctly visible; in upper jaw growing larger towards tip of maxillary, where they are directed forwards.

Opercle narrow, scarcely as wide as exposed portion of preopercle, the margin moderately oblique, not wavy.

Front of dorsal midway between base of caudal and front of pupil. Base of ventrals midway between origin of anal and articulation of mandible. Origin of anal behind last ray of dorsal.

Scales closely adherent, rather thick and firm.

Head  $3\frac{3}{8}$  in length; depth  $4\frac{1}{8}$ . D. 12; A. 20. Lat. 1. 40.

Color olivaceous, the dorsal region with black specking. A silvery band along middle of sides very narrow anteriorly but increasing in width to opposite anal fin, where it is as wide as eye. Snout and margin of caudal lobes dusky.

A single specimen,  $3\frac{1}{4}$  inches long, from Santa Margarita Island, off the coast of Lower California.

#### 7. *Myctophum regale* sp. nov.

In the type specimen the scales are wholly wanting, with the exception of two or three along the base of the anal, which have entire margins. The scars in the skin indicate that the scales along the lateral line were enlarged, those on middle of tail being twice the size of the ordinary scales. The species closely resembles in appearance *Myctophum* (*Nannobranchium*) *niger* Günther, but differs in the relative posi-

tion of the dorsal and anal. As the scales were wanting and the skin largely abraded in the type of *niger*, it may be that the scales along lateral line were in reality enlarged in that species.

Lateral line 37. D. 16; A. 19. Head  $3\frac{3}{4}$  in length; depth  $5\frac{1}{2}$ .

Eye small, slightly longer than snout,  $5\frac{1}{2}$  in head. In three specimens smaller than the type, the eye is  $5\frac{3}{4}$  in the head instead of larger, but they agree in all other respects.

Interorbital width  $3\frac{3}{4}$  in head. Maxillary not quite reaching anterior margin of preopercle, dilated slightly at extreme tip. Preopercular margin very oblique. Gill-rakers distant, slender, toothed, 5 + 10 in number, the anterior two very small. A deep oval depression without median crest on interorbital space and occiput, apparently covered in the fresh state by membrane. Ethmoidal ridge not high.

Teeth on vomer evident, separated by a median groove into two distinct patches, each of which is separated from the palatine patch by a very short interspace.

Front of dorsal slightly nearer adipose fin than eye. Base of fin equals length of maxillary; its origin is over axil of ventrals, and its last ray is over the sixth of the anal. Height of dorsal equals the length of its base.

Origin of anal falls under the fourth from the last ray of the dorsal, and its last ray is slightly behind the adipose dorsal.

Pectorals very slender, with fourteen rays, the upper filamentous and produced to opposite base of ventrals.

Ventrals with nine rays, the outer rudimentary, their tips reaching vent.

Scales entire, those along lateral line enlarged.

Color in spirits, uniform black on head, body, and fins, the inner rays of ventrals with a white blotch; a cream-colored streak on upper and one on lower side of tail. These streaks include three scales on back of tail, and eight below.

Three pairs of phosphorescent spots visible behind shoulder girdle, one of these on base of pectorals. A spot on the fourth scale behind pectorals, and another behind it and nearer the lateral line. Six pairs of spots in front of ventrals, three between ventrals and anal, and eleven at base of anal, seven along base of caudal peduncle, and three at base of lower caudal lobe. A spot is present half way between vent and lateral line, and one above fourth to last anal ray.

The type is a large specimen, about 5 inches long, taken at Station 2923, in 822 fathoms. Three smaller specimens were taken at Stations 2980 and 3070, in 603 and 636 fathoms.

### 8. *Alepocephalus tenebrosus* sp. nov.

Most nearly related to *Alepocephalus agassizii*, differing in the following respects:

Scales in a series from front of dorsal to lateral line more numerous, 15 or 16 in number (instead of 10).

Lower jaw not produced, shorter than the upper, and fitting well within it.

Eye smaller,  $4\frac{1}{4}$  in head. Pectoral larger,  $1\frac{1}{2}$  times orbit.

Body compressed, elongate, the depth  $4\frac{2}{3}$  to 5 in length; head 3 to  $3\frac{1}{2}$ . Symphysis of lower jaw produced downwards and forwards to form a short sharp point. Mouth moderately oblique, the maxillary reaching vertical behind front of pupil, its length (measured from tip of snout)  $2\frac{1}{2}$  in head. Mandible  $2\frac{1}{4}$  to  $2\frac{1}{2}$  in head,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  times length of snout.

Teeth in single series in premaxillaries, mandibles, and palatines. The lower jaw is well included, and its teeth shut between the series on premaxillaries and that on the palatines.

Snout short and compressed,  $3\frac{1}{4}$  in head. Eye moderate, nearly as long as snout,  $4\frac{1}{4}$  in head. Interorbital space nearly flat, with a low rounded ridge above each eye. The width above middle of orbit is contained  $1\frac{2}{3}$  times in diameter of eye. Preopercle with margin more or less free, marked with radiating striæ.

Dorsal fin beginning and ending a trifle in advance of the anal, the bases of the two fins equal. Distance from front of dorsal to base of median caudal rays equals one-third length of body.

D. 17; A. 17; V. 7; P. 10.

Pectorals long,  $2\frac{1}{2}$  in head, much longer than eye.

Distance of ventral fins from head equals length of head behind pupil.

Scales small, in about 90 cross-series; 16 scales between lateral line and front of dorsal and anal respectively. Scales of lateral line much enlarged, 55 in number, the tube forming a conspicuous raised ridge. Dorsal and anal scaled for one-third their height.

Color uniform blue-black.

Numerous specimens from Stations 2839, 2923, 2936, and 2980, in depths of 359 to 822 fathoms.

#### 9. *Porogadus promelas* sp. nov.

Closely resembling *Porogadus gracilis* Günther, but differing in the following respects:

Depth 3 in trunk (in *gracilis*  $3\frac{1}{2}$ ).

Eye 6 in head (in *gracilis*  $5\frac{1}{2}$ ).

Vomerine patch of teeth with the two arms incurved (U-shaped in *gracilis*).

Dorsal fin beginning behind the pectoral (over root of pectoral in *gracilis*).

An additional series of large scales (lateral line) along middle of sides, and another along ventral outline.

Trunk  $2\frac{1}{4}$  in tail ( $2\frac{2}{3}$  in *gracilis*).

Ventrals shorter, not reaching past tips of pectorals.

*Description.*—Tail produced into a filament, the caudal basis extremely narrow, supporting 5 long slender rays which are firmly bound together.

Head 2 in trunk; depth 3. Body  $3\frac{1}{4}$  to  $3\frac{1}{2}$  in tail.

Mouth terminal, large, the maxillary much dilated at tip, reaching well behind the eye,  $1\frac{1}{2}$  in head. Lower jaw included, the tip slightly produced.

Teeth in villiform bands on mandible, premaxillary, vomer, and palatines, the band on mandible, very narrow, that on vomer with the diverging arms much incurved, the anterior angle rounded. Tongue toothless, some of the basibranchials forming a sharply elevated denticulous crest. Gill laminae extremely narrow, the gill rakers of outer arch very long and slender, 1 (with 4 rudiments) above angle, 15 below.

Infraorbital chain with six mucous sinuses, the mandible with five, preopercle with five, and a number on top of head. These are all bridged over with very delicate membrane which is easily ruptured.

A row of low strong spinous points directed posteriorly on the ridge running backwards from the eye. No other spines on head, though a number of short spinous points are made evident when the skin is removed. Opercular spine rather weak.

A distinct membranous flap runs along the projecting edge of shoulder girdle, connecting pectorals with upper end of gill flap.

Pectorals slender, equaling postorbital part of head.

Ventrals each of a bifid filament, the two branches joined at the base for a very short distance. They are variable in length, reaching to or nearly to tips of pectorals, usually contained about  $1\frac{1}{2}$  times in head.

Dorsal beginning a trifle behind base of pectorals, its distance from occiput equaling distance of latter from front of eye.

Scales very small, apparently covering a part of top of head. Three series of large pores on sides; one from upper end of gill slit backwards parallel with dorsal outline; a second along middle of sides; the third beginning half way between base of pectorals and ventral outline, extending backwards on belly and along base of anal fin. These lines are all somewhat indistinct, and it can not be determined how far they extend backwards.

Color light brown, head (except occiput), mouth, gill-cavity, and abdomen jet-black. Fins dusky.

Five specimens, the largest  $9\frac{1}{2}$  inches long, from Station 3010, at a depth of 1005 fathoms, in the Gulf of California.

#### 10. *Siphostoma carinatum* sp. nov.

Closely related to *Siphostoma californiense* and *griseolineatum*, differing in the very slender sharply keeled snout, in the height and sharpness of the body ridges, the upper and lateral faces being all concave, and in the coloration.

No ridge on opercle. Breast and belly with a low median keel. Snout sharply keeled, the ridge ceasing on interorbital space to reappear on



occiput and first nuchal plate. Lateral ridge interrupted immediately above the vent.

Snout very slender, compressed, its length  $1\frac{1}{2}$  to  $1\frac{1}{2}$  times rest of head. Eye  $2\frac{1}{10}$  in postorbital part of head. Head and trunk contained  $1\frac{1}{2}$  to  $1\frac{1}{2}$  in tail. Trunk  $2\frac{1}{2}$  in tail.

Base of dorsal equaling length of head, covering nine and one-half rings, only the first of which is in front of the vent. The fin contains 39 to 44 rays, usually 43 or 44. Pectorals short, with 14 rays, the longest of which is one-third length of snout.

Body rings 17 or 18 + 40 to 42. B ood pouch on twenty-two anal plates. The keels on body are sharp and high, and the interspaces are transversely concave. In this respect the species differs conspicuously from *griseolineatum* and *californiense*, in both of which the dorsal surface is transversely convex, and the lateral faces flat or convex.

Color light olive or grayish, the back and upper part of sides mottled with brown, this frequently taking the form of rather wide ill-defined bars. In many specimens, the interspace between the bars is marked with a narrow pearly-white cross-bar. On lower portion of sides of tail, a brown streak between each two plates. Lower parts immaculate. Dorsal light, its basal portion with oblique brown streaks and spots. Central portion of caudal dusky, the fin broadly margined all around with white.

Many specimens, including both males and females, were taken at Stations 3027 and 3028, in the Gulf of California. The largest specimen is  $8\frac{1}{2}$  inches long.

This species differs from *S. aciculare* Jenyns, in the much longer snout and shorter pectoral fin.

#### 11. *Callechelys peninsulae* sp. nov.

A single specimen,  $10\frac{1}{2}$  inches long, from La Paz Bay, Gulf of California.

Color light yellowish (probably olivaceous in life), a series of large round brownish-black spots nearly as wide as interspaces between lateral line and base of dorsal. A second series of similar but much fainter spots alternating with the first below the lateral line. Top and sides of head with similar smaller spots, those on snout the smallest. Lower jaw with dusky mottlings. Anal translucent, unmarked. Dorsal with a dusky streak.

Head small,  $3\frac{3}{4}$  in trunk (without head). Snout projecting beyond lower jaw for a distance equaling diameter of eye. Cleft of mouth extending beyond eye, its length (from tip of snout)  $3\frac{1}{4}$  in head. Anterior nostril in a long tube (near tip of snout), the posterior on inner side of upper lip opposite front of eye.

Teeth in double series on all the dentary bones; those on maxillary, shaft of vomer and sides of mandible small, bluntly conic; those on head of vomer and front of mandible much broader though little longer, and also very blunt.

Eye very small, slightly less than half snout, and one-twelfth length of head. Snout  $5\frac{1}{2}$  in head. Gill-openings short, vertical, the length of the slit but one-half of the broad isthmus.

Vent much in advance of the middle of the length, the body contained  $1\frac{7}{8}$  times in the tail.

Dorsal fin beginning well forward on top of head, its origin equidistant between gill-slit and front of eye. Tip of tail sharp, free from fins for a distance equaling length of snout. Pectoral developed as a short deep membranous flap as wide as gill-slit; its length less than half its width. Delicate rays are visible with the aid of a lens.

#### 12. *Atherinops insularum* sp. nov.

Closely allied to *Atherinops affinis*, differing in the darker color, the slenderer form, the much smaller scales, and the shorter spinous dorsal, which is inserted farther forwards.

The lateral line contains 62 to 68 scales (52 to 56 in *affinis*); 5 scales between upper edge of silvery band and front of spinous dorsal (4 in *affinis*).

Front of dorsal much nearer tip of snout than is front of anal, the distance between base of last dorsal spine and front of soft dorsal greater than length of base of soft dorsal (much less than length of dorsal in *affinis*). Spinous dorsal constantly with 5 spines (6 or 7 in *affinis*).

Otherwise, in fins, dentition, and general proportions as in *affinis*. As in *affinis*, the inner fork of teeth is occasionally shorter than the outer, approaching the case of *Atherinops regis*, where this is the rule.

Found very abundant at San Clemente and San Nicholas Islands of the Santa Barbara Group, and farther south at Guadalupe Island. No specimens of *affinis* were taken at these islands, nor were any of *insularum* found on the shores of the mainland.

#### 13. *Mugil setosus* sp. nov.

Closely resembling *Mugil curema*, from which it differs widely in its much larger multiserial setæ, the longer narrower mouth, and the deeply falcate fins.

The mandibular angle is less than 90 degrees, and the length of the cleft of the mouth but little (about one-tenth) less than its width. The premaxillary setæ are in a narrow band, not arranged in definite cross-lines as in *Chaenomugil*. Those of the outer row are very long and numerous, curved and closely crowded; the inner setæ are much shorter, but can be readily seen without a lens, and are arranged in several irregular series. The mandibular setæ are shorter and slenderer than those on premaxillaries, but are larger than the premaxillary setæ of *M. curema*. They are in a single series. A narrow strip only of the maxillary is visible in the closed mouth.

Upper lip thick. Preorbital denticulated. Adipose eyelid partly covering pupil, but much thinner than in *curema* and related species,

the whole eye being visible through it in alcoholic specimens. The adipose mass lying behind the eye is also less developed, and encroaches but little on the opercle.

Eye large, equaling or slightly exceeding the length of the snout,  $3\frac{1}{4}$  to 4 in the head,  $1\frac{1}{2}$  in interorbital width. Suborbital very wide, as in *Mugil trichodon*.

Scales moderate, 20 in front of dorsal, 37 or 38 in the lateral line, 11 in an oblique series from vent to base of dorsal. Accessory scale on each side of spinous dorsal usually longer than the base of the fin. Axillary scale exceedingly thin and membranous. Soft portions of all the vertical fins scaled to tip; basal portions of the pectorals and ventrals also scaled.

Pectorals pointed, slightly falcate, as long as head behind front of pupil reaching tenth or eleventh scale on sides, failing to reach front of spinous dorsal by about one-fifth its own length.

Spinous dorsal lower than soft dorsal. Both soft dorsal and anal strongly falcate, the last rays much higher than middle rays, the anterior rays when depressed nearly reaching tips of last rays. Soft dorsal inserted over fourth or fifth ray of anal. Caudal longer than head, the lobes long and pointed.

Head  $3\frac{2}{3}$  to  $3\frac{3}{4}$  in length; depth 4. D. IV-I, 8; A. III, 9. Lat. l. 37.

Plain grayish above, silvery on sides and below, without stripes or other markings. Ventrals unmarked, the other fins slightly dusky, the caudal with a distinct black margin.

Very abundant at Clarion Island, of the Revillagigedo Group; not obtained elsewhere.

#### 14. *Diplectrum sciurus* sp. nov.

Most closely resembling *D. macropoma*, but differing strongly from this and all other species of the genus in the very numerous, long and slender gill-rakers, which are two thirds the diameter of the eye, even in young specimens; they are about 25 in number on the horizontal limb of the outer arch, instead of 12 as in *radiale* and *macropoma*, or 9 as in *formosum*.

A single rather wide cluster of spines at angle of preopercle, much as in *macropoma*, the width of the cluster  $4\frac{1}{2}$  to 5 in head, in specimens 5 inches long.

Scales on cheeks small, in 7 or 8 rather regular rows. Lateral line with about 52 pores; about 75 vertical rows of scales above it.

Vertical fins low, the height of soft dorsal one-third length of head.

Head  $2\frac{1}{2}$  to 3 in length; depth  $3\frac{1}{2}$  (in specimens 5 inches long). D. X, 12; A. III, 8.

In color this species differs from its near relatives in having no black on the inside of gill-cover, and in having a very light blue line below the orbit. The snout is without spots or streaks. The upper part of body is crossed with irregular dusky bars, and the soft dorsal and cau-

dal are marked with round yellow spots half as large as the pupil, ocellated with blue or dusky.

Small specimens only of this species have been secured, but these in considerable numbers, at Stations 3014, 3015, 3021, 3026, and 3033, all in shallow water in the Gulf of California.

#### 15. *Mycteroperca pardalis* sp. nov.

Not very closely related to any of the known species of this genus, being well distinguished by the following combination of characters:

Nostrils close together, the posterior the larger, as in all typical species of *Mycteroperca*. Dorsal spines low, the fourth the longest, the third equalling the fifth, the second still shorter. Soft dorsal and anal rounded, not falcate. Caudal rather deeply emarginate. Gill-rakers long, in increased number, the longest five-sixths the diameter of orbit, 23 or 24 rakers present on horizontal limb of outer arch.

Lower jaw strongly projecting. Teeth small, the outer row in mandible rigid, smaller than those of the inner series, which are depressible. The inner series widens into a patch at symphysis, in front of which stands the pair of very small inconspicuous canines. Outer series of teeth in upper jaw enlarged, canine-like, growing larger towards median line, where they terminate in two strong canines on each side. A patch of depressible teeth behind these canines in front of jaw, rapidly diminishing in size and becoming finely villiform on middle of premaxillaries. A U-shaped patch of villiform teeth on vomer, those laterally the largest, and a very narrow band on palatines. Tongue covered with minute teeth.

Maxillary reaching vertical behind middle of eye,  $2\frac{1}{4}$  in head. Snout  $3\frac{1}{2}$ ; eye 6. Interorbital space strongly convex transversely,  $4\frac{1}{4}$  in head.

Fourth dorsal spine the longest,  $3\frac{1}{2}$  in head; the second two-thirds its height. Longest ray of soft dorsal  $2\frac{1}{2}$  in head, the outline of fin everywhere convexly rounded.

Anal spines strong and low, the second half the height of the third, which equals length of eye and snout. Soft rays high, the angle rounded, the posterior portion of fin straight, not concave. Longest anal ray half head. Caudal lunate, the longest ray  $1\frac{1}{2}$  in head.

Scales small, not arranged in regular series, partially imbedded, those on head and hinder part of body smooth. Head wholly scaled, except premaxillaries and anterior part of maxillaries. Fins naked, except basal half of caudal. Sides covered with very minute numerous accessory scales. Scales apparently in about 90 transverse series above the lateral line, but extremely difficult to determine. Scales on cheeks, top of head, and above the lateral line anteriorly much reduced in size.

Head  $2\frac{1}{2}$  in length; depth 3. D. XI, 17; A. III, 11.

Color in spirits: Sides of head and body everywhere profusely covered with round brown spots, those on caudal peduncle largest, half the diameter of the pupil, those anteriorly and above becoming much

smaller, those on top of head about the size of a pin head. On sides these spots are surrounded with reticulations of grayish-silvery, this ground color darker and brownish on upper parts. A dark brown streak behind the maxillary, and one on membrane of premaxillary. Vertical fins light, soft dorsal and anal with brown streaks on membranes between the rays on basal half, and a few indistinct brown spots on middle of fin. Caudal brown-spotted, with a narrow white margin. Pectorals light at base, the distal half blackish, with a wide pale border posteriorly. Ventrals with brown streaks along membranes on inner face.

A single specimen, about 20 inches long, from La Paz Bay, Lower California.

16. *Bodianus scanthistius* sp. nov.

Characterized by its convex caudal, plain coloration (varied only by a black streak behind maxillary), its comparatively large scales, and the very high spinous dorsal with its deeply incised membranes.

Head  $2\frac{1}{2}$  in length; depth  $2\frac{3}{4}$ . D. IX, 17; A. III, 9; Lat. 1. (pores) 56; 75 oblique series of scales along sides above lateral line.

Mouth oblique, with mandible strongly projecting, the mandibular canines shutting outside of premaxillaries in closed mouth. Maxillary reaching vertical from behind pupil, its length half that of head.

Teeth in sides of mandible in two perfectly defined series, separated by a narrow groove-like interval. The outer teeth are nearly erect and rigid, the inner series directed obliquely inwards and very slightly movable (not strictly depressible). A patch of smaller movable teeth at symphysis, with the customary pair of canines in front of them. Premaxillaries with an outer series of strong teeth, terminating anteriorly in the double pair of enlarged canines. Behind this series is a wide band of minute villiform teeth, only slightly movable. Wide bands of similar villiform teeth on vomer and palatines, the vomerine patch without backward prolongation along median line. Tongue smooth.

Eye large, equaling length of snout, 5 in length of head. Interorbital space narrow, convex,  $6\frac{1}{2}$  in head.

Nostrils close together, the posterior round and much the larger, the anterior with a flap.

Preopercle minutely serrulate on hinder margin, which is convexly rounded. There is a shallow notch above the angle, and the latter is provided with two or three irregular lobes, coarsely toothed, lower margin smooth, entire.

Gill-rakers long and strong, 17 on horizontal limb of outer arch, the anterior short but scarcely rudimentary. Opercle with three flat spinous points.

Scales with entire edges, those on opercles and on middle of sides the largest, smaller above lateral line and along ventral outline, becoming

much reduced on breast and head (except opercles). Mandible with a few imbedded scales, maxillary and premaxillary wholly naked. Top and sides of head wholly scaled, including both limbs of preopercle and the opercular membrane.

First dorsal spine very short, the third the highest, half length of head, the fourth but little shorter. In the type specimen the fifth and sixth are rapidly shortened, while seventh, eighth, and ninth are again lengthened, thus forming a decided notch in the course of the spinous dorsal. The spines all have pungent tips, and seem to be uninjured. Dorsal membranes from third to sixth spines very deeply incised, that between third and fourth joining latter on the basal two-fifths of its length.

Soft dorsal and anal pointed, not falcate, the outline behind angle straight. The anal is higher than the dorsal, but is shorter than the spinous dorsal. Caudal rounded,  $1\frac{1}{2}$  in the head. Pectorals long, reaching beyond the ventrals, and nearly to front of anal. First anal spine concealed in our single specimen, probably mutilated, the second stronger but much shorter than the third, which is contained  $4\frac{1}{4}$  in the length of the head.

Color of head and body uniform, probably red in life; a black streak on cheeks, following hinder edge of maxillary. Fins all blackish on distal half. Basal part of fins scaly.

A single specimen, 16 inches long, from Station 3017, in 58 fathoms, near Cape Lobos, on the eastern shore of the Gulf of California.

#### 17. *Upeneus xanthogrammus* sp. nov.

A number of adult specimens secured in the harbor of La Paz, Lower California, agree closely with *Upeneus martinicus* from the West Indies, but differ constantly in the much smaller eye and the slightly smaller head.

In life they were red with a broad yellow streak along sides. The barbels reach the vertical from the preopercle. The teeth are in a narrow band anteriorly in each jaw, and in a single series laterally. Maxillary very wide posteriorly, projecting well beyond the border of the preorbital, its width two-thirds orbit. Eye  $1\frac{1}{2}$  in snout,  $3\frac{1}{2}$  in head, in specimens  $10\frac{1}{2}$  inches long ( $1\frac{1}{2}$  in snout,  $3\frac{1}{4}$  in head, in *martinicus* of the same size).

Head  $3\frac{1}{2}$  in length ( $3\frac{1}{2}$  in *martinicus*); depth 4 to  $4\frac{1}{4}$ . D. VII, I, 8; A. I, 6. Pores in lateral line 38, not counting two on base of caudal. Two and one-half rows of scales between lateral line and base of spinous dorsal. Fifteen developed gill-rakers on horizontal limb of outer arch, with 5 smaller rudiments.

Spinous dorsal not high, less than depth of body,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in head. Pectorals pointed, scarcely reaching tips of ventrals,  $1\frac{1}{2}$  in head. Ventrals reaching half way to front of anal. Caudal very deeply forked, the lobes sharp, the upper the longer, equaling the length of head.

This species seems to differ from *Upeneus flavolineatus*, from the Indian Ocean and Chinese Seas, in its lower dorsal fin and smaller scales, but I have had no opportunity to make a direct comparison.

18. *Pomacentrus leucurus* sp. nov.

Closely allied to *Pomacentrus fuscus*, but adults differing in the color, and in the length of the second anal spine.

Head and sides brown, darker on the upper half of body. No blue spots or lines, and no yellow. Caudal peduncle brown like rest of body. All the fins jet-black, the pectorals abruptly margined behind with pure white.

Posterior margin of preopercle and lower edge of suborbital ring serrulate. Second anal spine very strong; measured from base of sheath much higher than any of the dorsal spines, and as high as highest soft anal ray, its length contained  $1\frac{1}{2}$  times in head. Margin of anal rather bluntly rounded; the soft dorsal pointed, but not much produced, the longest ray  $1\frac{1}{2}$  in head. Caudal lunate, the lobes very bluntly rounded, the upper longer than the lower. Ventrals with the outer ray produced, reaching past vent. Pectorals broad, rounded,  $1\frac{1}{2}$  in head.

Lateral line with 20 pores; 7 to 9 cross-rows of scales behind its end.

Interorbital region transversely convex. Anterior profile arched, a slight depression usually to be recognized on nape and on snout.

Head  $3\frac{1}{2}$  in length; depth 2. D. XII, 16; A. II, 13.

Numerous specimens,  $4\frac{1}{2}$  to  $5\frac{1}{2}$  inches long, were taken at Socorro Island, one of the Revillagigedo Group, off the coast of Mexico.

19. *Gobius microdon* sp. nov.

Allied to *Gobius sagittula*, but much less elongate, with plain coloration, and with minute teeth, those in the upper jaw in a single series. The species belongs apparently to the section called by Bleeker *Ozyrichthys*, but differs from the typical species in the much less elongate form and the horizontal mouth.

Head and body compressed, everywhere deeper than wide. Mouth at lower profile of snout, nearly horizontal, the lower jaw extremely weak, broadly rounded anteriorly. Maxillary reaching vertical from hinder margin of pupil, nearly half length of head.

Teeth minute, scarcely perceptible without the use of a lens, those in upper jaw in a single series. Mandible with a close set outer series of teeth, separated by an interval from an inner narrow band of still smaller teeth.

Interorbital space narrow, less than diameter of pupil. Isthmus wide, the gill-slits extending little below base of pectorals.

Scales minute and cycloid anteriorly and on belly, becoming larger posteriorly; on sides they are everywhere ctenoid behind the middle of

spinous dorsal. Belly wholly scaled; nape scaled forwards nearly to orbits, but with a narrow median naked streak running back to front of dorsal. Breast and sides of head naked.

Dorsal fins not connected. First four spines filamentous, the longest longer than head, reaching when depressed to base of third ray of soft dorsal. Soft dorsal and anal similar, not high, the last rays not extending beyond the base of caudal. Caudal lanceolate, much longer than head. Pectorals and ventrals about equal, reaching vent.

Head  $4\frac{1}{2}$  in length; depth 5. D. VI-13; A. 14. Lat. 1., 62.

Color nearly uniform light olive, with minute darker punctulations which sometimes form darker margins to the scales. An oblique dusky streak on opercle. Three or four oblique obscure dark cross-bars on spinous dorsal, and four or five on tail. Ventrals with white pigment,

Two specimens, each about 2 inches long, from the San Juan Lagoon, immediately north of the Rio Ahomè, Mexico.

#### KEY TO SPECIES OF BOLLMANNIA.

- a. A conspicuous black spot on posterior portion of spinous dorsal. Body deep, the least depth of caudal peduncle greater than diameter of orbit.
- b. Filamentous dorsal spines very long, reaching beyond middle of soft dorsal when depressed. Lower caudal rays black. Dorsal spot conspicuously ocellated. Eye large, 3 to  $3\frac{1}{2}$  in head..... OCELLATA.
- bb. Filamentous dorsal spines shorter. Lower caudal rays not black, and dorsal spot not ocellated. Eye smaller,  $3\frac{1}{2}$  to 4 in head..... CHLAMYDES.
- aa. No black spot on spinous dorsal. Body slender, the depth one-fifth the length. Least depth of caudal peduncle not greater than diameter of orbit.
- c. Head large, 3 to  $3\frac{1}{2}$  in length. No black spot at base of caudal. Fins low,  
MACROPOMA.
- cc. Head smaller,  $3\frac{1}{2}$  in length. A black spot at base of caudal. Fins higher,  
STIGMATURA.

#### 20. *Bollmannia ocellata* sp. nov.

Very close to *Bollmannia chlamydes*, the numerous specimens differing from the latter constantly in the following respects:

The eye is larger, 3 to  $3\frac{1}{2}$  in head ( $3\frac{1}{2}$  to 4 in *chlamydes*). The filamentous rays of spinous dorsal are much longer, reaching in adults, when laid back, to or nearly to end of base of soft dorsal,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  times length of head. Rarely the filamentous dorsal rays are little more elongate than in *chlamydes*. Black spot on posterior part of spinous dorsal jet black, conspicuously ocellated with white. A black streak along lower margin of caudal, including several of the lower rays, and running from base to tip of fin. No dusky bars visible on sides in any of the types. Fins dusky; membranes uniting outer rays of ventrals white, instead of black, as in *chlamydes*. No black spot at base of caudal. Branchiostegal membrane with a medial black streak. Anal blackish.

Head,  $3\frac{1}{2}$  to  $3\frac{3}{4}$  in length; depth,  $4\frac{1}{2}$ . D. VII-14 or 15; A. 14. Lat. 1. 27.

Teeth in a narrow band in both jaws, the outer series in upper jaw and both outer and inner series in lower jaw enlarged but not canine-



like. Maxillary not reaching vertical from middle of pupil, half length of head. Interorbital width less than half diameter of pupil. Opercle short, its length being less than the diameter of the eye.

Pectorals nearly as long as head, a trifle more than length of ventrals, which scarcely reach vent. Caudal much longer than head in adults, 7 or 8 scales before dorsal.

Numerous specimens from the northern part of the Gulf of California, at Stations 3031 and 3035, in 30 and 33 fathoms.

This species may vary into the typical *chlamydes*, but the material before us does not justify us in so identifying it.

#### 21. *Bollmania macropoma* sp. nov.

This species, represented by numerous specimens, is characterized by its slender form, low fins, large opercle, and comparatively plain coloration.

The depth is one-fifth the length; the caudal peduncle is correspondingly slender, its least height equaling the diameter of the eye. The head is very large and heavy, contained 3 to  $3\frac{1}{2}$  times in the length. The opercle is conspicuously larger than in *ocellata*, agreeing in this respect more nearly with *chlamydes*. Dentition as in other species of the genus. Eye large,  $3\frac{1}{4}$  to  $3\frac{1}{2}$  in the head.

Dorsal spines slender, comparatively little produced, the longest usually not reaching the base of the first ray of second dorsal, and never beyond the base of the second or third ray.

Soft dorsal and anal low, the posterior rays usually not reaching the rudimentary caudal rays when depressed, about half length of head.

Pectoral long, extending beyond front of anal; the ventrals to or nearly to vent. Middle caudal rays produced as usual, varying in length.

Color in spirits: Light brownish, the sides with three vertical dusky bars. Spinous dorsal dusky, but without distinct black spot. Caudal slightly dusky, with rather large elliptical light spots, as in *chlamydes*, the lower rays not black and no black spot at its base. Ventrals blackish, including anterior membrane. Second dorsal and anal dusky, without evident light spots. Branchiostegal membranes sometimes slightly dusky, but not black.

Scales as in *chlamydes*; 28 vertical rows along sides, 8 to 10 in front of dorsal.

Many specimens from the Gulf of California just north of La Paz Bay, at Station 2996, in 112 fathoms.

#### 22. *Bollmannia stigmatura* sp. nov.

This species agrees with *macropoma* in its elongate form, comparatively low fins, and in the absence of a black spot on the spinous dorsal. It differs conspicuously in the very short head and narrow opercle and in the presence of a black spot at base of tail. The eye is also larger

and the fins higher. None of the specimens show dusky bars on the sides; this a conspicuous feature in *macropoma*.

Head short,  $3\frac{3}{8}$  in length; depth 5. Least depth of caudal peduncle slightly less than the diameter of the eye. Eye large,  $2\frac{1}{2}$  in head. D. VII 15; A. 11. Lat. 1. 28.

Dorsal spines filamentous, longer than in *macropoma*, the longest reaching base of fifth to seventh ray of second dorsal. Posterior rays of second dorsal and anal often reaching base of median rays when depressed. Pectorals not reaching beyond front of anal.

The color in spirits is almost uniform light brownish. The lips are black, the fins only slightly dusky, the caudal with elliptical light spots. A roundish dusky spot at base of caudal. Branchiostegal membranes not black.

Many specimens from the northern part of the Gulf of California, at Stations 3016 and 3017, in 76 and 58 fathoms.

23. *Gobiosoma crescentalis* sp. nov.

Head  $3\frac{3}{8}$  in length; depth  $6\frac{1}{4}$ . D. VII-12; A. 11.

Body very slender, the head depressed, broad and flattened above, the head and body of nearly equal depth throughout.

Mouth small, oblique, the maxillary not extending beyond the vertical from posterior border of orbit,  $2\frac{1}{2}$  in head. Eyes small, equaling length of snout,  $5\frac{1}{4}$  in head,  $1\frac{1}{2}$  in the rather broad interorbital space. Teeth in bands in both jaws, the outer series enlarged, canine-like, and distant.

Fins all small, the caudal short and rounded from a broad base. Pectoral as long as head without snout. Ventrals short, not reaching two-thirds the distance from their base to vent. Dorsal spines not filamentous.

Skin wholly naked.

Color in spirits: Lower half of head and body uniform warm brown, the back much lighter, the two areas separated by a well-defined line along middle of sides. This line passes through the orbit and through the middle of the base of the pectoral fin. Back light grayish, with brownish reticulations, which tend to form five or six indistinct darker bars uniting with the darker area below the lateral line. A conspicuous brown crescent at base of caudal and pectorals, broad below, narrowing above, margined in front with whitish. Anal brown at base. Dorsal and caudal with small brown spots forming faint cross series.

A single specimen,  $1\frac{1}{2}$  inches long, from Station 2825.

*Chriolepis* gen. nov. (Gobiidæ).

Closely related to *Gymneleotris* Bleeker, differing in the total absence of scales, and the absence of enlarged canines in the front of the mandible.

Head and body compressed, the former as deep as wide.

Ventrals separate, near together, the inner rays longest, each with one spine and five soft rays.

Teeth in a rather wide band in upper jaw, the outer series somewhat enlarged. Teeth in mandible in a single series, similar to outer row in upper jaw, none of them canine-like. Gill-slits narrow; no dermal flaps on inner edge of shoulder girdle. Body scaleless.

(Type, *Chriolepis minutillus* sp. nov.)

24. *Chriolepis minutillus* sp. nov.

Depth  $4\frac{1}{2}$  in length; head  $3\frac{1}{2}$ . D. VII-12; A. 11.

Mouth oblique, the maxillary reaching to below middle of orbit,  $2\frac{1}{2}$  in head. Eyes high up, but with lateral range, separated by a narrow interorbital space less than diameter of pupil. Diameter of orbit nearly twice length of snout,  $3\frac{1}{2}$  in head.

Dorsal spines high and slender, but not filamentous, the longest half length of head. Soft dorsal rays higher, nearly two-thirds length of head; the anal lower. Caudal short, broadly rounded, the depth of caudal peduncle half length of head. Length of pectoral equaling that of head without snout.

Uniform light brown on head and body, above and below. Fins dusky, the anal blackish.

A single specimen, 1 inch long, from Station 2825.

25. *Gillellus ornatus* sp. nov.

With the elongate form and general appearance of *Gillellus arenicolus*, but differing in the subequal jaws and in the long anterior portion of the lateral line.

The head is conical, acute, very small; the jaws nearly equal, the lower slightly longer than the upper, but not noticeably protruding. In this respect the species resembles most strongly *G. semicinctus*, from which it varies widely in the general form and proportions. Snout extremely short, scarcely equaling the diameter of the minute eye; diameter of orbit about one-seventh of the length of the head.

Mouth oblique, the maxillary one-fourth length of head, reaching nearly to vertical from posterior margin of orbit. Lips without fringes. Eyes separated by a narrow septum, the interorbital width being less than the diameter of the pupil. Opercular fringes few and small, flat, and not terminating evident ridges as in *Dactyloscopus*.

Head  $4\frac{1}{2}$  in length; depth 8. D. III-IX, 31; A. II, 34.

Dorsal beginning well forwards, its origin less than diameter of orbit behind the posterior line of occiput. The anterior detached part of fin consists apparently of three rays, the first of which is the longest, the second and third equal and short. The fourth spine again is longer. The spines are as usual slenderer than the rays, and show no articulations, but are with some difficulty discriminated from them. Pectoral as long as head.

The anterior part of lateral line runs immediately along base of dorsal, without intervening scales, as in other members of this genus.

It is much longer than in *arenicolus*, and is contained  $1\frac{1}{4}$  times in the posterior median portion. There are three scales between the posterior part of lateral line and base of the dorsal.

Color similar to that of *arenicolus* and *semicinctus*. Light olivaceous, unmarked below middle of the sides, the back and upper half of sides with eight brown bars which extend downwards to lateral line. The upper part of each bar has a lighter central area. The light areas between the bars are marked more or less with brown, which sometimes forms indistinct secondary bars. A blackish bar at base of caudal, and a faint streak below eye. A large pearly blotch on opercle.

A single specimen, about 2 inches long, from Station 2828 in the Gulf of California.

26. *Prionotus gymnotethus* sp. nov.

Closely related to *Prionotus xenisma*, differing conspicuously in the wholly naked breast and belly.

The largest specimen is  $3\frac{1}{2}$  inches long. Head 0.43 of length to base of caudal; depth 0.30; eye 0.11; interorbital width 0.045; snout 0.18; mouth 0.16; length of pectorals 0.30; length of ventrals 0.25; length of second dorsal spine 0.21.

Body heavy anteriorly, tapering rapidly to the slender tail. Head large; striæ fine, numerous, scarcely to be distinguished on top of head, which is finely granular. Snout long; profile concave; the orbital region abruptly elevated. Preorbital on each side projecting beyond the mouth in a narrow lobe, which is usually sharply triangular, the two lobes strongly divergent. Free edge of preorbital with a row of very fine serræ. Anterior nostril with a long flap. Mouth small, the maxillary one-third length of head, a naked area behind it. Eyes very prominent, the preocular ridge high, bearing one strong spine. Interorbital space very narrow, concave, one-tenth length of head. A deep transverse groove on top of head behind eyes.

Supraocular spine short and blunt. Occipital and nuchal spines flat, bluntish. Temporal ridge with two spinous projections. Opercular, preopercular, and humeral spines, long and sharp. Preopercular spine with a very strong accessory spine at base, from which a low ridge extends forwards to middle of cheeks, where it ends in a weak spine. Gill rakers 1+7, slender, of moderate length.

D. X or XI-10 or 11; A. 11.

Second dorsal spine the highest, the first two spines minutely serrulated in front. Pectorals very short, one-third the length, reaching but little past front of anal. Caudal slightly lunate.

Scales very small, none on breast or belly, the naked area extending upwards behind pectoral fin to humeral spine, and narrowing backwards to front of anal. Region in front of spinous dorsal naked.

Color in spirits, brownish above, light below, the dorsal region and top of head often with small dark spots. One, or rarely two, small

black ocellated spots between fourth and fifth dorsal spines. Pectoral mostly dusky, light at base below, and edged with white. A dusky blotch on outer portion of lower caudal lobe.

Several specimens taken in shallow water in the Gulf of California.

27. *Careproctus melanurus* sp. nov.

*Diagnosis.*—Sucking disk very small, three-fifths diameter of eye, immediately below which it is inserted. It is separated from the vent by less than its own diameter. Eye 4 in head (in specimens 6 to 7 inches long). Mouth very broad, horizontal. Pectorals not notched, the lower rays exerted and elongate, but the median ones not evidently shortened. Gill openings confined to region above base of pectorals.

Color light rose-red; the tail with the posterior portions of dorsal and anal, the inner face of pectorals, the mouth and gill cavities jet-black.

*Description.*—Head heavy, with vertical cheeks, short bluntly-rounded snout, and very broad flat interorbital space. Width of interorbital space slightly more than half length of head.

Mouth very broad, horizontal, with short lateral cleft, the maxillary reaching to below middle of eye. Width of mouth equals length of snout and eye. Teeth short and strong, in narrow bands in both jaws; except at symphysis, the teeth of the bands are arranged in regular series running from inner edge of jaw forwards and sideways. Tongue and roof of mouth papillose and toothless. Gill rakers tubercular.

Nostrils single, in a very short wide tube, which is nearer eye than cleft of mouth.

Gill opening oblique, entirely above base of pectorals, the length of slit equaling snout and half eye.

A series of six pores along under side of mandible and interopercle; none on preopercle. Three above premaxillary, and two pairs on snout. No pores along side of body.

Sucking disk extremely small, little more than half diameter of orbit, its center and the middle of pupil equidistant from tip of snout. The disk is separated from vent by a trifle less than its own diameter.

Pectorals forming a continuous lamella, following the margin of gill flap and lower jaw, the two fins becoming closely approximated in front of sucking disk. The fin is not notched, the rays decreasing regularly forwards. Eight to ten of the anterior rays are exerted and elongated, the anterior four or five becoming again shorter and thicker, and wholly free from the membrane. Pectorals scarcely reaching front of anal, two-thirds to three-fourths length of head.

Dorsal beginning over gill slit, the distance from origin of anal to snout,  $2\frac{1}{2}$  in length. Dorsal about 58; A. 50; P. 30. The fins are enveloped in thin lax skin, so that it is impossible to count rays accurately without dissection. Posterior dorsal and anal rays well overlapping base of caudal, their membranes joining middle of caudal rays.

Head  $4\frac{1}{2}$  to  $4\frac{3}{8}$  in length; depth  $4\frac{1}{2}$  to  $4\frac{1}{2}$ .

Color light rose-red on body and fins, the abdomen usually dusky. Inner face of pectorals, the caudal, the posterior portions of dorsal and anal, and the inside of mouth and gill openings, black. The peritoneum is silvery, with more or less black-specking, sometimes nearly black.

Several specimens, the longest about 6 inches long, from Stations 2840, 2891, 2892, 2925, and 3076, in depths from 178 to 339 fathoms off the coast of California and Oregon.

28. *Paraliparis cephalus* sp. nov.

Head very large, high, and compressed, the upper profile descending in a strong convex curve behind the occiput; body tapering posteriorly to a very narrow thread-like tail. Sides of head vertical or inclining inwards below. Height of head twice height of body opposite origin of anal. Interorbital space transversely rounded, its width slightly less than length of snout and eye. Eye of moderate size, 4 in head, without vertical range. Mouth oblique, the premaxillaries but little below lower margin of eye. Lower jaw longest, with the tip protruding. Maxillary reaching vertical from the posterior margin of the eye, slightly more than the length of the head.

Gill slits narrow, confined to a region above the base of the pectorals. The membrane connecting the branchiostegal rays with the shoulder girdle very delicate and easily ruptured, broken in all but one of the specimens. The vent is distant less than a diameter of the orbit from this point, being below the front margin of the preopercle.

Teeth in narrow bands in both jaws, the teeth of the bands arranged in oblique series running outward and forwards. Palate toothless.

Head  $4\frac{1}{2}$  in length, greatest depth (at occiput)  $4\frac{3}{8}$ .

Pectoral small, without about fourteen rays, the upper ones closest and forming a projecting lobe, which extends backwards to beyond origin of anal. The succeeding rays are shortened and wide-set, and have the tips free from the membrane. The fin is somewhat mutilated, but is apparently notched, not however to the base, the median portion having wide-set rays. Upper margin of pectorals on a level with tip of lower jaw.

The dorsal begins slightly behind the head, and the first ray of anal is under the eighth of the dorsal.

Color light reddish, the abdomen blue-black. Inside of mouth and gill opening white. In the smallest specimens, 2 inches long, the color is dusky on head and body, and on inside of mouth. Longest specimen  $3\frac{1}{2}$  inches.

This species differs from *Paraliparis membranaceus* in the structure of the pectoral fins and their much fewer rays, in the position of the vent (below the posterior margin of the orbit in *membranaceus*), the different outline of head, and in the larger more oblique mouth. In none of the specimens of *cephalus* are there fin-folds extending forwards from front of dorsal and anal, as described in *membranaceus*.

Several specimens from stations 2839, 2892, 3070, and 3071, in 284 to 685 fathoms off the coast of California and Oregon.

29. *Paraliparis mento* sp. nov.

Closely allied to *Paraliparis membranaceus* Günther, but with very heavy lower jaw, which projects beyond the upper. The premaxillaries are high, on the level of the lower rim of the orbit, and the form is much more elongate. The pectorals are inserted much lower, and the vent is farther forwards.

Head  $5\frac{1}{2}$  in length without caudal, equaling the greatest depth. Eye a trifle less than interorbital width, greater than snout, 3 in head. Mouth oblique, with lateral cleft, the maxillary reaching slightly beyond the middle of the orbit, half as long as the head. Chin very prominent, the mandible with a wide membranous border, which forms anteriorly a broad free fold over anterior portion of base of pectorals.

Teeth in both jaws comparatively long and slender, not tricuspid, arranged in bands, those in upper jaw at least in oblique rows, as usual in *Liparids*. Nostril with a single opening and without tube. Gill opening but little wider than diameter of eye, confined to region above base of pectorals.

D. 57; A. 43; P. 16.

Pectorals inserted very low, their upper rays below level of angle of mouth. The base is almost horizontal, and the anterior ends of shoulder girdle form prominent projections below tips of mandibles. The fins are very deeply notched, the upper lobe extending slightly beyond origin of anal, the shortest middle ray about one-fourth that length; a few of the lower rays elongate and partly free from the membrane, the longest equaling the length of the upper lobe. The middle pectoral rays are wide-set, but there is no rayless interval between the lobes. The two pectorals converge to immediately behind symphysis of lower jaw, where their bases meet.

The anal opening is vertically below middle of orbit.

Dorsal beginning a trifle behind the upper angle of gill opening, the anal origin under its eighth ray.

Skin loosely investing the head and body.

Light reddish, made dusky by minute dark dots. Abdomen blue-black. Mouth and gill cavity light or dusky.

A single specimen,  $3\frac{1}{4}$  inches long, from station 3071, in 685 fathoms off the coast of Oregon.

30. *Trachyrhynchus helolepis* sp. nov.

Snout depressed, flat, narrowly triangular, tapering to a sharp point, its lateral ridges continuous backwards over suborbital chain and across cheeks. Interorbital space wide and flat. Ethmoidal ridge not prominent. Snout  $2\frac{1}{2}$  in head, its greatest width  $1\frac{1}{2}$  in its length. Eye large, equaling interorbital width, 4 in head.

Mouth wholly inferior, U-shaped, overpassed by the snout by a distance contained  $3\frac{1}{2}$  in head. Barbel slender, short, less than one-fifth diameter of orbit. Teeth finely villiform, in very broad bands in both jaws, none of them enlarged. Maxillary reaching to or almost to vertical from hinder margin of orbit,  $3\frac{1}{2}$  in head. Opercle very small, triangular, its length behind preopercular margin scarcely more than half diameter of orbit. Outer arch not adnate to the opercle, its lower limb with seventeen short gill rakers, which are not tubercular.

Distance of dorsal fin from nape  $3\frac{1}{2}$  in head; the two dorsal fins closely approximated. Second dorsal ray not spinelike, soft and flexible, and not longer than the succeeding rays, its length two-thirds the diameter of orbit.

Vent located immediately in front of origin of anal fin, its distance from ventrals contained  $1\frac{1}{2}$  times in length of head.

Ventrals short, inserted well in advance of base of pectorals, the outer ray little produced, its length  $1\frac{1}{2}$  in diameter of orbit.

Scales all with their margins embedded, and therefore appearing non-imbricated; the central portion of each projecting tubercle-like, and bearing a single strong central spine, with sometimes two or three smaller ones. Belly and breast sometimes covered with much smaller scales similarly armed. No naked area between bases of ventrals. Enlarged plates along bases of dorsals and anal bearing each a strong compressed backwardly-curved spine, usually without distinct serrations; from the base of the central spine, radiate lines of short spinous points. The dorsal series of plates are continued forwards to the nape, the predorsal portion of the included groove covered with scales. The ventral series scarcely extend beyond vent, but extend farther posteriorly than do the dorsal plates. Scales on top of head with a median serrated ridge. Temporal fossæ small but evident, naked.

Head  $3\frac{1}{2}$  in total; depth 7. D. 11.

Color apparently dark brown; gill cavity and peritoneum black.

A single specimen, 18 inches long, from Station 2818, in deep water off the coast of Central America.

### 31. *Macrurus* (*Malacocephalus*) *pectoralis* sp. nov.

Mouth wide, lateral, the short snout projecting beyond premaxillaries for a distance about equaling one half diameter of orbit. Sub-orbital ridge and lateral ridge on snout inconspicuous. A strong median ridge on snout, and a pair of parallel ridges forwards from above nostrils. Maxillary reaching well behind vertical from posterior margin of orbit,  $2\frac{1}{2}$  in head. Teeth in two somewhat irregular series in front of premaxillaries, the outer series enlarged, the inner directed obliquely inwards, the two series merging into one laterally. Mandible with a single row, similar to inner series of upper jaw. Barbel short, three-fifths to two-sevenths diameter of orbit. Eye moderate,  $1\frac{1}{2}$  in snout,  $4\frac{1}{2}$  to 5 in head. Angle of preopercle bluntly rounded, not pro-



duced. Outer gill arch adnate, as usual in *Macrurus*, seven short tubercular gill rakers present on its free portion.

Head 6 in total length, the tail frequently mutilated, however; the head then appearing larger in proportion. Depth  $1\frac{1}{2}$  in head; D. 10.

First dorsal spine slender and weak, with one or two small retrorse prickles near its middle. Distance between dorsals equal to two-fifths base of first. Ventrals with seven rays. Pectorals with seventeen.

Vent immediately in front of anal origin, its distance from base of ventrals slightly more than half head.

Pectorals long and narrow, reaching vertical from ninth or tenth ray of second dorsal, more than half length of head. Outer ventral ray produced into a long slender filament reaching five-sixths the distance from its base to front of anal.

Scales rather small, ten or eleven in a series between lateral line and origin of second dorsal or middle of first dorsal. Scales on sides very thin and flexible, readily deciduous, each furnished with low diverging ridges, usually three in number, bearing few minute spinules, and projecting but little beyond the margins of the scales. Entire head, including snout and mandibles, invested with much smaller scales irregularly imbricated, those on opercles marked similarly to those on sides, the others usually each with a single median ridge terminating in a spinous point. No naked spots or pits on head or between ventral fins. A small naked area behind and below axil of pectorals.

Color light grayish, darker on belly and head. Mouth, gill cavity, and peritoneum black. Lateral line black. Dorsals and ventrals dusky. Anal lighter, edged with blackish. Pectorals black.

It is not evident whether this species should be placed in *Optonurus* (with serrated dorsal spine) or in *Malacocephalus*. The value of the character separating them does not seem to be great.

Specimens have been taken at Stations 3071, 3074, and 3075, in depths of 685 to 877 fathoms, off the coast of Oregon.

### 32. *Lycodes diapterus* sp. nov.

Body slender, the depth 12 in length; head  $5\frac{1}{2}$  to 6.

Mouth small, somewhat variable in length, the maxillary reaching vertical from between front and middle of pupil,  $2\frac{1}{2}$  to 3 in head.

Teeth in premaxillaries in a double row throughout, the two series well separated, rarely with one or two teeth intercalated showing traces of a third row. The teeth of inner series are small and directed obliquely inwards; those of outer series anteriorly enlarged, becoming smaller on sides of jaw.

On front of mandible the teeth are in a broad band, in which traces of three or four irregular series can be made out; none of these enlarged. Laterally the teeth are arranged in a single series, those opposite middle of cleft considerably enlarged. A small patch of from two to five teeth on vomer. Palatines with a single row much shorter than premaxillary patch.

Eye large, usually longer than snout, 3 to  $3\frac{3}{4}$  in head; snout  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; interorbital width about 10. Nostrils with a short inconspicuous tube. Mandible and preopercular border with deep pitlike excavations, which are not evident in fresh specimens; no evident mucous pores on head.

Gill openings wide, extending below base of pectorals, the gill membranes joined to isthmus for a distance equaling two-fifths length of slit. Gill rakers very short, almost tubercular, but compressed and slightly movable, about fifteen present on anterior limb of outer arch. A wide slit behind fourth gill.

Distance from origin of dorsal to tip of snout  $4\frac{1}{2}$  to  $4\frac{4}{5}$  in length. The dorsal rays are simply forked, the divisions remaining closely connected. Distance from origin of anal to tip of snout equals one-third the length.

Ventrals short, inserted under middle of opercle. Pectorals deeply notched in both young and adults, the median rays much shorter than either upper or lower. The lobe produced by the elongate lower rays varies in length, being sometimes shorter than upper lobe, sometimes longer. The rays of lower lobe are thickened, and undoubtedly serve as a support to the fish when resting on the bottom, as has been observed in so many other forms. The pectorals contain twenty or twenty-one rays. In the structure of this fin the present species seems to differ from all previously described forms, with the exception of *L. esmarki*, in which the notched condition of the fin does not persist in the adults.

Scales small, embedded, covering entire body and vertical fins. The scales on nape are much reduced in size, and in two specimens ( $11\frac{1}{2}$  and  $7\frac{1}{2}$  inches long) are continued onto occiput, which they entirely cover. In another specimen, 9 inches long, the occiput is naked, and in one 5 inches long the anterior part of nape is likewise naked. In the latter, as in other specimens, the dorsal and anal are well scaled.

Lateral line single, wavy, extending from above gill slit obliquely downwards to near base of anal, along which it is continued for a variable distance, not reaching base of caudal.

*Color*.—Dusky brownish, blue-black on belly, and along anterior portion of base of anal. Eight or nine narrow white bars on sides, most conspicuous in the young, in which they are continued up on dorsal fin, and become forked below on middle of sides, forming A-shaped marks. In adults, these bars become faint, or wholly disappear. When present, they are not continued on dorsal, and are usually vertically divided by a streak of the ground color. In the small specimen there is a distinct black blotch on margin of anterior dorsal rays. In adults, the vertical fins are brownish on basal portion, their distal half black. Pectorals and ventrals deep blue-black. Mouth, gill cavity, and peritoneum, dusky or black.

Several specimens, from Stations 2892, 2896, 3067, and 3077, in depths from 82 to 376 fathoms, off the coasts of California and Oregon.

33. *Symphurus fasciolaris* sp. nov.

Depth  $3\frac{2}{3}$  in length. Head  $5\frac{1}{2}$ . D. 94; A. 77. Lat. 1. 95.

Eye small, 7 in head. Cleft of mouth reaching to below middle of lower eye.

Color light olive, with numerous roundish brownish-black spots much larger than eyes, the largest of which are arranged in five vertical dusky crossbars, the spots being connected by a darker ground color. A vertical dusky streak through eye. A wide dusky crossbar, bounded by darker lines on cheeks. Dorsal and anal posteriorly black, with narrow white margin. Caudal jet black, with white edge. Ventral white.

Several specimens were dredged in shallow water in the Gulf of California.

34. *Antennarius reticularis* sp. nov.

First dorsal spine short, very slender, and filiform, not reaching tip of second, terminating in a short, fleshy flap. Second spine moderately robust, flexible, not curved backwards, wholly free, and without membrane. Third spine nearly erect, not free, depressible with difficulty; not curved as in *Antennarius sanguineus*.

D. III, 12; A. 7.

Spines on body rather coarse and shagreen-like, with expanded undivided tips.

Color in spirits: Top of head, including dorsal spines and front of soft dorsal, coral-red; the body otherwise light gray, broadly reticulated on sides and below with heavy black lines, which inclose 5 or 6 large pale spots. Pectorals, ventrals, and anal with narrow terminal and wide medial black bars. Soft dorsal uniformly light.

This species resembles closely *Antennarius sanguineus*, but differs in the straight erect spines, the color, and the character of the plates on the body.

A single specimen,  $1\frac{1}{4}$  inches long, from Station 2825, Gulf of California.

# THE BIOLOGY OF THE HYMENOPTEROUS INSECTS OF THE FAMILY CHALCIDIDÆ.\*

BY  
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The parasitic Hymenoptera as a whole may be classed among the entozoic parasites, yet their life is entozoic through only one stage of the existence of the individual. In the adult stage they are active creatures of an especially high degree of organization, and exhibit no trace of the degradational features characteristic of the epizoic parasites, nor yet of those entozoic forms whose whole life round is parasitic. Nor are their larvæ especially degraded beyond those of the non-parasitic families of the same order.

The phenomena of parasitism among the *Chalcididæ* do not differ in any marked degree from those characteristic of the three other great families of parasitic Hymenoptera—the *Ichneumonidæ*, *Braconidæ*, and *Proctotrypidæ*. In all four we normally have the eggs laid by the female on or beneath the skin of the host-insect, and the parasitic larva, on hatching, lives in the majority of the cases within the body of its host. It often happens that parasites, even of the same genus, are external feeders when parasitic upon endophytous insects, and internal when parasitic upon outside feeders. Some few species, however, are external upon external feeders.

Resembling, then, the other families in these general habits, the following pages will indicate of the *Chalcididæ* our knowledge of their particular modes of life and their relations to other insects and to each other—in fact their general economy.†

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\*SIR: I take pleasure in recommending for publication in the Proceedings of the Museum the accompanying paper by Mr. L. O. Howard, on the "Biology of the *Chalcididæ*." This paper is based very largely on the collections of the Museum, as the material in this family has been specially studied and arranged by Mr. Howard.

Respectfully yours,

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† In preparing this paper I have had the very rich collection of the National Museum constantly before me, and with Prof. Riley's generous permission have freely used his own unpublished notes and those of the Division of Entomology.

## THE INSECTS AND STAGES OF INSECTS INFESTED BY CHALCIDIDS.

Representatives of all of the original Linnæan orders of insects are parasitized in one or another of their stages by species of this family. Of the fifteen orders of Brauer, forms of but seven are infested by chalcidids, and these are the seven Linnæan orders in their restricted sense. Neither *Thysanura*, *Ephemeroptera*, *Odonata*, *Plecoptera*, *Platyptera*, *Dermoptera*, *Thysanoptera*, nor *Mecoptera* have ever been proven to be parasitized, largely from the fact that the larger number are aquatic in their early stages,\* while most of the land forms are excessively minute, but, of course, the vast majority of insects belong to the older and more important orders. The most extensively parasitized orders are *Lepidoptera*, *Hymenoptera* and *Hemiptera-Homoptera*.

*Lepidopterous* insects in all stages are infested. The minute chalcidids of the genus *Trichogramma*, apparently few in number of species, but enormously abundant in individuals, attack the eggs of *Rhopalocera*, *bombycids*, *noctuids*, *geometrids*, and *tortricids*, and probably of members of other families. So numerous are these tiny creatures at times that hundreds of thousands of eggs of injurious *noctuids* are destroyed by them, and so small are they that twenty will develop in a single egg of *Papilio turnus*, the entire contents of which will not exceed 1.5 cubic millimeters. Reverting again to the numbers of individuals, Hubbard found in 1880 that *Trichogramma pretiosa*, alone and unaided, almost annihilated the fifth brood of the cotton worm (*Aletia ryliana*) in Florida, fully 90 per cent of the eggs of this most abundant and prolific *noctuid* having been infested. (Fourth Report U. S. Ent. Com., p. 103.) It is interesting to note that these little egg-parasites, although so very abundant in this country, seem comparatively rare in Europe, although the family and its different genera were originally founded on European material. They seldom occur in the European lists, and a few years ago Dr. Gustav Mayr wrote me asking for a specimen of *Trichogramma*, saying that he had never seen one!

The eggs of some of the larger *Lepidoptera* are also parasitized by species of the genus *Eupelmus*. Prof. Riley, for instance, has reared species of this genus from eggs of *Antheraea pernyi*, *Telea polyphemus*, *Saturnia io*, *Datana ministra*, and of a sphingid on cherry, probably *Smerinthus myops*.

The larvæ of *Lepidoptera* are more extensively parasitized than perhaps any other group of insects. Among the Chalcididæ representatives of eleven of the twenty subfamilies affect *lepidopterous* larvæ. Certain forms attack them when young, others when half grown, and

\* Hymenopterous parasites of aquatic insects are excessively rare. *Agriotypus armatus*, an ichneumonid, has been proven by Westwood to be a parasite of the caddis-fly, *Aspatherium picicorne*, and one of the Ephydras of our alkaline western lakes is attacked by a chalcid, possibly, however, after the puparia are washed up upon the banks. Moreover, in Europe the eggs of *Agria*, one of the dragon-flies, are said to be parasited by a species of the mymarid genus *Polynema*.

others when full grown and just about to transform to pupæ. Those of the latter class, mainly pteromalines, issue from the pupæ of the host-insect, while the others destroy the host-larva before its transformation.

The pupa itself is seldom attacked, yet certain of the pteromalines which preferably oviposit in larvæ about to transform will also lay their eggs in just-formed pupæ. The same is the case with certain members of the genus *Chalcis*, particularly those parasitic upon diurnal Lepidoptera, and I am not sure that *C. flavipes* does not oviposit by preference on the fresh chrysalids of *Chlorippe clyton* and *Agraulis vanillæ*.

The adult lepidopteron is not parasitized. I have recorded (Proc. Entom. Soc. Washn., I, 95) the rearing by Scudder of *Ichneumon instabilis* from the adult of *Chionobas semideæ*, the egg of the parasite having evidently been laid upon the chrysalis of the butterfly, but a similar instance has never to my knowledge been observed with a chalcidid.

Representatives of all families of Lepidoptera are attacked, the micros more abundantly than the macros, while among the latter the *Noctuidæ* (except in the egg state) seem to be most exempt, doubtless from the nocturnal habit of the larvæ and from the fact that so many of them burrow under ground during the day. The average chalcidid is essentially a creature of sunshine and of air and is most active in the middle of the day in the warm light of the sun.

Among the Hymenoptera the *Tenthredinidæ* are parasitized in the egg state by *Trichogramma*, as shown by Lintner in the case of *Nematus ventricosus*, while their larvæ are infested by species of the subfamilies *Pteromalinæ*, *Eurytominae*, *Toryminæ*, *Eulophinæ*, and *Entedoninae*, and a species of *Perilampus* is reported by Giraud as parasitizing the European sawfly, *Athalia spinarum*. From the galls of *Cynipidæ* are reared very many chalcidids, those belonging to the subfamilies *Toryminæ* and *Eurytominae* taking first rank in point of numbers. So abundantly do species of these two subfamilies attack our commoner oak galls that it is frequently a matter of great difficulty to rear the original gall maker. Then there are also several species of the subfamilies *Eupelminæ*, *Pteromalinae*, *Encyrtinæ*, *Tetrastichinæ*, and *Eulophinæ* (genus *Olinx*). The great number of widely differing forms reared from these galls and the fact that their transformations are all undergone in secret in the interior of the gall make their interrelationships a matter of great confusion. The *Toryminæ* and *Eurytominae* are primary parasites, although Wachtl has thrown doubt upon one of the former and Westwood upon one of the latter, as I shall show in a further paragraph. Nearly all of the others I am inclined to think are secondary, but only the most carefully isolated rearings coupled with dissections of the galls at successive stages will enable us to settle this question. *Olinx* is considered by Mayr to be primary, but representatives of all of the other subfamilies we know to be occasionally hyperparasitic.

Upon the families of the Hymenoptera Parasitica many chalcidids are parasitic. I know no case in which a chalcidid is a parasite of a proctotrypid, but the instances in which they parasitize ichneumonids, braconids, and even members of their own family are very numerous. Even the highest subfamily, *Chalcidinae*, contains some hyperparasites. Thus Riley has recorded a species of *Spilochalcis* reared from the cocoons of the braconid parasite (*Meteorus hyphantriae*) of the fall webworm (*Hyphantria cunea*) (Bull. 10, Div. of Ent., 2d. ed., p. 57), while Walsh reared *S. albifrons* from the cocoons of *Pezomachus minimus*, supposed to be parasitic on the army worm (*Leucania unipuncta*). In the *Eurytominae*, *Eurytoma* has been reared from *Cryptus* and from *Microgaster* cocoons. In the *Eupelminae*, *Eupelmus* has been reared from *Isosoma*, *Apanteles*, and *Meteorus* and is probably frequently hyperparasitic in galls. In the *Encyrtinae*, *Encyrtus artaceæ* was reared from an ichneumonized cocoon of *Artace punctistriga*. Many pteromalines are hyperparasites, while the tetrastichines nearly all have this habit. With the *Elasminae*, certain species of *Elasmus* have been reared from the cocoons of *Limneria* and *Apanteles*, although the majority are probably primary parasites, while with the *Elachistinae* there is no doubt that *Cirrospilus* is usually, if not always, hyperparasitic. Certain of the entedonines are also secondary parasites, as, for instance, the forms so commonly reared from the naked pupæ of *Cratotechus*. The tetrastichine genus *Melittobia* is also parasitic upon *Monodontomerus* and *Leucospis* in the cells of bees and wasps, although it also feeds upon the aculeate larvæ.\*

The aculeate hymenoptera are also attacked by chalcidids. *Leucospis* is reared from the cells of *Osmia* and *Chalicodoma*. Species of the torymine genus *Monodontomerus* infest the pupæ of *Anthophora* and are reared from the cells of *Chalicodoma* and *Osmia* in Europe, while in this country they are reared from cells of *Melissodes* and *Anthophora*, as shown by the notes of the Division of Entomology, and from *Osmia*, as proven by Rev. J. L. Zabriskie. A species of the allied genus *Diomorus* is reared from the cells of *Crabro* and *Stigmus*. With the *Eurytominae*, one species is reared from the cells of *Prosopis* and other pith-digging forms. An *Encyrtus* has been reared from *Eumenes* and there is an old record by De Geer of the rearing of *Pteromalus* from some aculeate. The latter, however, may be a mistake and the ease with which such an error can be made is shown by the fact that specimens of the common *Pteromalus puparum* were recently received by Dr. Riley as having been reared from the cells of a mud-wasp. In those cells, however, must have been stored lepidopterous larvæ which were the true hosts of the pteromali. Rearings from the cells of fossorial Hymenoptera are, therefore, apt to be uncertain. The abnormal tetrastichine genus

\* Since this was written specimens of a *Melittobia* have been received from Mr. A. N. Caudell, Oklahoma, reared from a dipterous puparium found in a mud-dauber's cell. The puparium itself was also sent by Mr. Caudell, so there can be no doubt as to the accuracy of the observation, which is one of extreme interest.

*Melittobia* is reared in Europe from the cells of *Odynerus*, *Trypoxylon*, *Osmia*, *Stelis*, *Chalicodoma*, and other bee genera, but is also a hyperparasite, preying upon larvæ of *Leucospis* and *Monodontomerus*. Species of this genus are found in this country parasitic in the nests of *Megachile*, *Ceratina*, *Anthophora*, and *Pelopæus*.

Chalcidid parasites of the Hemiptera-Heteroptera are very rare, the only ones being the eupelmids which infest the eggs of these insects, and a few species of *Encyrtus* which have the same habit. Even these are not so abundant, however, as the proctotrypid parasites of the same eggs. With the Hemiptera-Homoptera, however, they are very numerous, although the insects of the homopterous families *Cicadidæ*, *Fulgoroïdæ*, *Membracidæ*, *Cercopidæ*, and *Jassidæ* are singularly free from the attacks of hymenopterous parasites. Some of them are preyed upon by the externally attached larvæ of the proctotrypid subfamily *Dryininae*, but the only chalcidids which I know to attack members of this section are a trichogrammine, forming a new genus, which infests the eggs of the buffalo tree-hopper (*Ceresa bubalus*), in the United States, and a species of *Eupelmus* which is said to inhabit the eggs of *Oicada* in Europe. The gall-making *Psyllidæ* are attacked by several species of *Encyrtus*, while the *Aleyrodidæ* are attacked by the encyrtine genus *Thysanus*, the aphelinine genus *Encarsia* and the tetrastichine genus *Gyrolasia*. The most abundant parasites of the latter insects, however, are the exceedingly minute species of the family *Mymaridæ*. When we come to the family *Coccidæ* we find that its species are infested almost exclusively by chalcidids. The species of one entire subfamily, the *Aphelininae*, are bark-louse parasites with the exception of a very few species which attack aphidids and aleyrodids. They seem to be confined mainly to the true scale-bearers (*Diaspinæ*), but a few infest the naked bark lice. The latter, however, are most extensively parasitized by members of the subfamily *Encyrtinae*. Hardly a species of scale insect can be found which does not have its formidable parasite in some species of one of these two subfamilies, while many of them are also attacked by species of *Mymaridæ* which I take, from their minute size to be egg parasites in many if not most instances. Outside of these three groups almost no parasites of *Coccidæ* are known, the species of the genera *Dilophogaster* and *Ophelosia*, provisionally placed in the subfamily *Pireninae*, forming the principal exceptions. It is true that an occasional *Pteromalus* or *Tetrastichus* is reared from barklice and one or two other genera are mentioned in the European lists, but I think it quite likely that most of these forms are hyperparasitic and that they have really developed upon some primary encyrtine.

The most important of the parasites of the *Aphididæ* or plant lice are the braconids of the subfamily *Aphidiinae*, but the plant lice have many proctotrypid parasites (all belonging to the subfamily *Ceraphroninae*) as well as many among the *Chalcididæ*. Besides the few aphelinines there are a number of species of the subfamily *Pteromalinae*, particularly those



of the genus *Isocratus*, which are commonly reared from these insects. The chalcidids which are perhaps most abundantly reared from plant lice belong to the pteromaline genus *Pachyneuron*. The closely allied genus *Pachycrepis* is, I feel sure, hyperparasitic, attacking primarily the aphidiid parasites of plant lice, and the suspicion is growing in my mind that the same may be the case with *Pachyneuron*. If this be so the apparently anomalous host-habits of these insects which I have pointed out (Proc. Entom. Soc. Washington, Vol. II, pp. 105-109) are readily explainable.

Only a few families of Coleoptera are parasitized by chalcidids. So far as I know none have been reared from beetles of the adaphagous, or lamellicorn series.\* In the clavicorn series the species of the family *Coccinellidæ* are frequently parasitized in larva state by the several species of the encyrtine genus *Homalotylus*. Hubbard has reared these parasites from full grown larvæ of *Hippodamia convergens*, while Mr. F. H. Chittenden has shown me specimens which he has reared from larvæ of *Coccinella novemnotata*, *Mysia pullata*, and *Psyllobora vigintimaculata*.

In the serricorn series the wood-boring species of the families *Buprestidæ* and *Ptinidæ*—the subfamily *Bostrichinæ* of the latter in particular—are frequently parasitized by chalcidids, the former by *Chalcis* and *Pteromalus* and the latter principally by the species of the pteromaline tribe *Chiropachides*. *Pteromalus* and *Entedon* are also frequently reared from the burrows of these insects, while *Eurytoma* is said to have been reared from a *Bostrichus* by Ratzeburg. Moreover, Popenoe has reared species of each of the handsome eupelmine genera *Charitopus* and *Ratzeburgia* from the bostrichine *Amphicerus bicaudatus* (See Bull. 3, Kans. State Agric. Exper. Sta.). The ptinid subfamily *Anobiinæ* is also parasitized by *Pteromalus*. The family *Cioidæ* in this group is also rarely parasitized and the peculiar little entedonine *Astichus arithmeticus* is reared in Europe from *Cis glabratus* and *Ennearthron affine*. Among the phytophagous Coleoptera the *Cerambycidæ* are occasionally infested by pteromalines, probably, however, only as hyperparasites upon some of the numerous ichneumonid and braconid parasites of the insects of this group, while there is a somewhat doubtful record by Ratzeburg of the rearing of a *Eurytoma* from a cerambycid burrow, and Ashmead's *Eurytoma dorcaschemæ* was reared by Popenoe from the burrows of *Dorcaschema alternatum*. I am informed, however, by Mr. Marlatt who was with Prof. Popenoe at the time, that there is no certainty as to this parasitism and this *Eurytoma* is in my opinion likely to be a hyperparasite. Concerning all these records of rearings from wood-boring larvæ, in fact, there must always be the greatest doubt on account of the numerous insects which inhabit moribund wood. Many of the records are manifestly inaccurate in their conclusions and a knowledge of the true state of affairs will be a matter of slow growth and continuous observation, just as in an endeavor to arrive at proper conclusions concerning hyper-

\* Since this was written Mr. Ashmead informs me that he has reared a *Eurytoma* from the larva of *Dorcus* in Florida.

parasitism. From the *Bruchidæ* have been reared pteromalines, entedonines and tridymines while the eurytomine genus *Bruchophagus* of Ashmead is parasitic, so far as we know, upon insects of this family. With the *Chrysomelidæ* we should naturally expect many parasites, yet but few are known. The European *Chalcis parvula* is reared from *Cassida filaginus*, *Eupelmus annulatus* from a *Chrysomela*, and *Homatotylus flaminus* from *Galeruca californiensis*. From *Odontota suturalis* Dr. Riley has reared *Spilochalcis odontotæ*, *Sympiezus uroplata*, and *Derostenus primus*—the latter probably a secondary parasite. While from the eggs of the same species he has reared *Trichogramma odontotæ*. (See my paper on the parasites of *Odontota suturalis*, *Entomologica Americana*, 1, 117.) A few entedonines and pteromalines are recorded from this group, but are probably secondary parasites. Among the Heteromera I know only of Giraud's record of *Eurytoma histrionica* from *Mordellistena episternalis*. The *Rhynchophora*, however, are rather extensively parasitized. Perhaps most common are the pteromalines of the tribe *Chiropachides*, as *Rhaphitelus*, *Rhopalicus* and *Chiropachys*. Certain of the *Oleonymides* and *Roptrocercus*, *Aetroxys*, *Holcæus* and others of the *Pteromalides* are also reared. Of the other subfamilies the *Eurytominae* are represented by several species of *Eurytoma*, the *Eupelminæ* by *Eupelmus*, and the *Tridyminae*, *Eulophinae*, *Elachistinae* and *Entedoninae* by species of the typical genus of each subfamily. Two species of the curious trichogrammine genus *Poropœa* are said by Ratzeburg to have been reared by Reissig, the one from small larvæ of *Apoderes* and the other from the leaf roll of *Rhynchites*. Both of these records need confirmation as otherwise the egg-inhabiting life is uniform throughout the *Trichogramminæ*. There is also an European record of a torymine from a species of *Apion*. The comparatively slight extent of chalcidid parasitism upon Coleoptera which we have just indicated as a summary of our present knowledge, may prove to be indicative of the true condition of their mutual relations, but this I am inclined to doubt for the reason that the early stages of the beetles have not, on account of the difficulty of the study, been so carefully observed as those of insects of other orders. I think it safe to say, however, in view of such facts as are upon record, that the *Brachionidæ* are more abundantly parasitic upon Coleoptera than are the *Chalcididæ*.

Of the Diptera we have many chalcidid parasites, which are, however, vastly more abundant as destroyers of the *Nematocera* than of the other suborders or series. The midges of the family *Oecidomyiidae* are particularly great sufferers from the attacks of these parasites. The gall-making forms are pierced by the same genera of chalcidids which parasitize the galls of the cynipids and to a certain extent those of the gall-making tenthredinids and microlepidoptera, namely those of the subfamilies *Eurytominae* and *Toryminæ* very abundantly, with species of *Pteromalinae*, and, more rarely, *Tridyminae*, *Eupelminæ*, *Encyrtinae*, *Entedoninae*, and *Elachistinae* and with certain tetrastichines and one species

of *Elasmus* as hyperparasites. The nongall-makers are attacked in the larva state by certain encyrtines and eupelmines and by a number of genera of the true *Pteromalides*. The *Tipulidæ* are also attacked by a species of the subfamily *Pteromalinae*. Parasites of the *Brachycera* are rare, the only ones worthy of note being two species of *Smicra* and one of *Monodontomerus* which infest *Stratiomys* in Europe, according to Giraud, but with the *Aschiza* they become more abundant, and from species of *Syrphidæ* are reared *Bothriothorax*, *Encyrtus*, and *Eupelmus*, and very commonly *Pachyneuron*, while Giraud has reared a species of *Pteromalus* from a *Conops* larva infesting a *Bombus*. With the *Muscidæ calyptrate*, *Lamprotatus* and *Pteromalus* are reared from anthomyiid puparia, *Chalcis* is reared from *Sarcophaga*, *Pachylarthrus* from *Lucilia*, *Bothriothorax*, *Entedon*, and *Pteromalus* from *Musca*, and the extremely useful dipterous parasites of the family *Tachinidæ* are attacked in the larva state by certain species of *Chalcis*, by *Perilampus*, by *Pteromalus*, *Eurytoma*, and *Monodontomerus*. With the *Muscidæ acalyptrate* the gall-making *Trypetidæ* have practically the same chalcidid parasites as the gall-making *Cecidomyiidæ*. Those curious inhabitants of our western alkaline lakes belonging to the family *Ephydridæ* are parasitized by a species of *Pteromalus*, specimens of which were sent to Dr. Riley by Mr. H. W. Turner, who reared them from puparia of *Ephydra californica* collected at Borax Lake, California. The *Agromyzidæ* are infested by pteromalines of the tribes *Michogastrides* and *Sphegigastrides*, and the *Oscinidæ* are commonly parasitized by chalcidids of the subfamily *Entedoninae*.

With the Orthoptera we have no chalcidid parasites except on the eggs. The egg-cases of certain *Blattidæ* are parasitized in Europe by *Entedon hagenowii*, but this may be a secondary parasite on *Erania appendigaster*. In this country, however, the egg-cases of a Florida tree cockroach are infested by a species of *Eupelmus*, specimens of which have been received by Dr. Riley from Mr. Hubbard. The species of the curious genus *Podagrion*, which possesses characters of both the *Chalcidinae* and *Toryminæ*, are invariably parasitic all over the world in the egg-cases of the insects of the family *Mantidæ* wherever these occur and we have in addition in this country a *Eupelmus* parasitic in the same egg capsules, as has been shown by Ashmead (Proc. Ent. Soc. A. N. S. Phila., 1885, xv). Among the *Gryllidæ* the eggs of *Æcanthus* in the United States are parasitized by a species of *Eupelmus* and by a species of the eurytomine genus *Ashmeadia*, as shown by the notes of the Division of Entomology. They are also infested by several proctotrypid parasites. Among the *Locustidæ* the eggs of a species which oviposits in pith in Europe are stated by Giraud to be inhabited by a species of *Aphelinus*, while in the United States the eggs of one or more of the species of Katydids are infested by *Eupelmus mirabilis*.

Among the Neuroptera we know parasites of only the *Myrmeleontidæ* and the *Hemerobiidæ*. *Myrmeleon* in Europe is infested by *Hybothorax*

*groffii* and *Haltichella tarsalis*, while there is also a record to the effect that *Chalcis minuta* has been reared from insects of this genus. These parasites presumably issue from the cocoons of the ant lions. I have already summarized the parasites of the *Hemerobiina* in the Proceedings of the Entomological Society of Washington, Vol. II, pp. 123 and 124. No chalcidids are known to infest these insects in Europe, but in this country the encyrtine genus *Isodromus* is reared from the cocoons of *Chrysopa*. The *Chrysopa* larva is evidently pierced by *Isodromus* when full grown, for it invariably succeeds in spinning its cocoon. A species of *Perilampus* has also been sent in from Los Angeles, Cal., by Mr. D. W. Coquillett, who reared it from a *Crysopa* cocoon. Mr. N. Banks has recently sent in specimens of a *Tetrastichus*, which he reared from these cocoons at Shreveport, La., the past June. This parasite, however, is undoubtedly secondary.

#### HOW THE CHALCIDID LARVA LIVES.

This is a subject which greatly needs careful investigation. It is probable that the same general facts will be observed with chalcidid larvæ as with the larvæ of other parasitic hymenoptera, but even here our information is so slight and so contradictory that it is very difficult to make general statements. Situated at different points between the tissues of their hosts, the quick-growing internal-feeding larvæ absorb through the mouth the blood of their victims and rapidly become adult. The old idea that they feed upon the fatty tissue in a mandibulatory manner seems, at least in the majority of cases, to be untrue. The larva of *Ichneumon atropos*, however, according to Newport, seems to destroy part of the "fatty sacculi" of its host. The mandibles are piercing, and not comminuting, and the other mouth parts are fitted for the reception of liquid food. Exuviation has not been observed in the internal feeders, although Newport has seen it repeatedly with *Paniscus*, an external parasite of lepidopterous larvæ; "but," he writes, "the thrown-off covering is of such extreme tenuity and is so gradually and imperceptibly removed, without interfering with the form or enlargement of the body, that, hitherto, the deciduation of the tegument of the apodal larvæ of Hymenoptera has always escaped the observation of naturalists." With the internal feeders there is the same reason against sudden exuviation that there would be against the passing of excrement; either would produce inflammation and the premature death of the host. And so there is no provision in the structure of these larvæ for the passing of the waste products of the body until they have reached full growth and a certain amount of vitality in the host insect is no longer necessary to their existence. Up to this time the alimentary canal of the parasitic larva has consisted of a simple sac, closed at its posterior extremity, and with an imperforate intestine proceeding from it, without an anal opening. When full growth is attained, however, and the assimilation of food begins to be arrested, as no longer needed by the

(rapid growth of the larva, a rapid change takes place and the alimentary canal becomes narrow and elongated, the cæcal extremity becomes perforated, and by a rapid proliferation of cells the rectal tube is lined with epithelium and, with the change to pupa, the excrement is voided. Of great interest in this connection are the recent observations of M. E. Bugnion upon the structure and life history of *Encyrtus fuscicollis*, a parasite of the European *Hyponomeuta cognatella* (Receuil Zoologique Suisse, v. 1890, pp. 435-70, reviewed in Journ. Royal Mic. Soc., 1891, part 3, June, p. 329). He found in the abdominal cavity of the caterpillars a closed membranous tube inclosing the "embryos" of the chalcid and also the nutritive substance on which the larvæ feed. This tube seemed to be formed by the ova themselves. According to his observations the larva has an anus, quite in contradiction to the general statements which I have just given. When the store of nutriment in this closed tube is exhausted, according to M. Bugnion's observations, the larvæ burst into the perivisceral cavity of the caterpillar where they feed upon the lymph of their host.

The question of the respiration of these internal feeders is more of a puzzle. The probabilities are that subsisting entirely upon freshly aërated blood, and in intimate connection with the air supply of the host insect, sufficient oxygen is thus derived to purify their own circulatory fluid, rendering unnecessary any direct connection between their stigmata and those of the host which Gerstaecker is said to have traced. When we come to egg parasites the case becomes complicated and here is a field for study. Ganin has shown a most curious hypermetamorphosis with the larvæ of the proctotrypid genera *Teleas*, *Polynema*, and *Platygaster* (sic!) inhabiting eggs, and of the chalcidid genus *Ophionurus*, but their economy is not understood. We have in the Chalcididæ an egg parasite of a higher type than any of these in *Eupelmus* and careful studies of the larval growth and economy of *E. mirabilis*, for instance, which inhabits the large eggs of *M. crocentrum* are much needed, particularly, as it seems to me, in this matter of its respiration.

This whole branch of the subject has in fact been neglected, and a most interesting field is here open for some careful worker.

The large majority of chalcidid larvæ live within their hosts. As a general rule, however, those which are parasitic upon leaf-mining and wood-boring larvæ, and in fact all endophytous larvæ, feed externally; and the same may be said of the larvæ of the hyperparasites. The growth of the larvæ of this class has not been carefully studied, although Newport (Trans. Linn. Soc. XXI, 83, 1852), has published many interesting observations on the larva of *Monodontomerus nitidus* which inhabits the cells of *Anthophora*, and is externally parasitic upon the larvæ and pupæ of the bee.

True external chalcidid parasites of ectophytic larvæ are rare and belong mainly if not entirely to the subfamily *Elachistinae*. The larvæ of *Euplectrus*, all of the species of which have this habit, were studied

as early as 1832 by Fonscolombe, but it is from Schwarz (Amer. Naturalist, 1881, pp. 61-63) that we have the most careful account of the larval development. We quote his words concerning the larvæ of *Euplectrus comstockii* Howard:

The delicate eggshell splits longitudinally in the middle of the back and discloses the white larva of the parasite, which gradually works the eggshell more and more down the sides of its body where, for some hours, it remains visible as a black line, but within less than twelve hours it disappears from view beneath the rapidly growing parasite larva. This last, as soon as it has freed its head from the eggshell, pierces the skin of its victim and thereafter remains stationary with its head buried. As soon as it has fairly begun to feed, the white color changes to a bright bluish-green, and the segments and spiracles which in the newly hatched larva were barely visible under high magnifying power are now readily seen. The growth of the larva is very rapid, but seems to vary according to the season, averaging three days in August and four days in September. When full grown the larvæ crowd each other, and if there are five or more of them on a caterpillar they form a semi-globular lump of very striking appearance. Usually their growth is uniform, and retardation in development of individuals in the group results in death. When full grown they turn yellowish-white and relax their hold.

The worm which up to this time showed no signs of being affected, except by its sickly yellowish color and by its very slow growth, collapses and dies as soon as a single one of the parasitic larvæ withdraws, and the same fate overtakes those *Euplectrus* larvæ which are at the time less advanced in their development or immature. If one of the parasitic larvæ be removed by hand both the victimized worm and the remaining parasites quickly dry up.

The presumption that the *Euplectrus* larvæ may migrate from one worm to another is unfounded. They always remain stationary on the worm, which the parent fly has chosen as its victim, and they never even move from the spot where the egg has been laid until they are full grown. Every attempt I made to transplant a larva from one worm to another invariably resulted in the death of the parasite.

These observations may be compared with the accounts of external-feeding ichneumonid larvæ by De Geer, Newport, Fitch, and Poulton.

#### HOW FAST DOES IT DEVELOP?

There is evidently considerable variation in the rapidity of development of the chalcidid larvæ, and consequently of the number of annual generations. This variation is in part according to the particular parasite and in part to the habits of the particular host-insect. It is rather more rapid as a general thing, however, with the *Chalcididæ* than with either the *Braconidæ* or the *Ichneumonidæ*. Ratzeburg has shown that in Europe *Pteromalus puparum* occupied on one occasion from June 11 to July 14 to undergo its entire transformations from egg to adult—thirty-seven days; but in this country Webster has recorded an instance (*Insect Life*, I, 225) in which the eggs of the same parasite were laid August 9, the adult insect developing August 27—seventeen days later. Hubbard has noted (Fourth Report U. S. Ent. Com., p. 103) that the egg of *Aletia xyliæ* gives forth the adults of *Trichogramma pretiosa* on the seventh day after it was stung by their parents. *Euplectrus comstockii* has been shown by Schwarz to develop from egg to adult in Alabama in midsummer in seven days.

These instances will suffice to indicate the extreme rapidity of growth of many of these parasitic larvæ. The question of number of annual generations is, I believe, entirely one of appropriate food. Copulation takes place immediately after the adults issue, the males usually appearing a little in advance and awaiting with impatience the egress of the females. Very soon after coition the females are ready to oviposit, and in the case of polyphagic species or species which attack insects of great abundance whose generations overlap there must be many so-called "broods" in a single season.

Where host-insects are not accessible, however, there can be no doubt but that the impregnated female can live a long time, and hibernation in this state is frequent. Another common method of hibernation is in the full-grown larva. Those species which issue from the pupæ of Lepidoptera usually overwinter in this condition, transforming to a short pupal stage in the spring.

A curious fact, and one contradictory to the usual rapid development of these insects, is given by Scudder (Butt. New Eng., p. 701), who surmises that the pteromaline parasitic upon *Euphydryas phaeton* possibly requires two years to complete its transformations, since all of the chrysalids of the butterfly which hang through the winter are parasitized. The butterfly larvæ it seems hibernate and transform to chrysalids in May and June, giving out the butterflies in June. When parasitized, however, they hang all summer and through the following winter, the parasites appearing on the wing the following June. While it appears to me that the possibilities in this interesting case are overstated in supposing that the eggs of the parasite are necessarily laid upon the larvæ of the butterfly in late summer and fall, it is still remarkable, for, even on the supposition that the egg is laid in the chrysalis, the parasite must occupy a full year in development, always providing the facts stated are strictly correct.

The preceding remarks apply strictly to the parasites of external feeders, for with parasites of endophytes the period of development is undoubtedly longer. With gall parasites, for instance, I believe that there is never more than one annual generation, for the galls themselves are of annual development and must be pierced at a certain stage of their growth. In such cases, moreover, there may be a retardation of development due to absence of natural moisture, as where galls are kept dry indoors. In such cases Ashmead has shown (Proc. Entom. Soc. Wash., I, 91) that cynipids may be retarded for two years and then brought forth by the application of water to their galls. The same laws will undoubtedly apply also to their parasites.

It may also be worth recording here that Mr. A. Craw, of Los Angeles, Cal., considers that *Dilophogaster californica* mihi has but one annual generation. This insect is a parasite of the Black Scale of California (*Lecanium oleæ*), and destroys annually 75 per cent of these scales. According to Mr. Craw the parasite deposits eggs in the mature scales

only, and at the time when these contain eggs, so that the 25 per cent. which escape the parasites are sufficient to again infest the tree, from the fact that each female scale contains from seven hundred to one thousand eggs. From the slow growth of the scales, however, full ten months elapse before they have developed sufficiently to be attacked once more by the *Dilophogaster*, which is not known to have any other host insect. This reasoning indicates only a probability, and Mr. Craw records no actual observations upon mature infested scales showing the rate of growth of the chalcidid. (See Bulletin 57, California State Board of Horticulture, Sacramento, 1891.)

Mr. D. W. Coquillett, of Los Angeles, Cal., in a manuscript report submitted recently to Prof. Riley, states that he bred this species on the 14th and 27th of June from scales collected on the 25th of April, and that on the 22d of September he found a full-grown larva under an adult black scale. He has also captured specimens of the parasite on January 17, July 2, August 31, September 21, and October 12. He argues from these facts that there are at least two and perhaps even three generations of this species annually.

#### HOW THE LARVA TRANSFORMS.

As a rule chalcidid larvæ which are internal feeders on their hosts transform internally into naked, more or less coarctate pupæ.

With certain *Encyrtinæ*, for one of which Dr. Riley has proposed the excellent descriptive name of the "inflating chalcis-fly," particularly of the genus *Copidosoma*, but also of *Bothriothorax*, *Homalotylus* and perhaps others, the larvæ, inhabiting the host insect in great numbers, when about to pupate cause a marked inflation in the host larva by the formation of oval cells around the parasite. This inflation and the pupal cells which cause it are very noticeable in thin-skinned host larvæ. With a small larva like that of *Lithocolletis* the appearance of a dipterous puparia is produced. The nature of this cocoon-like cell and the method by which it is produced are unknown. Its structure shows it not to be silk, nor yet the last larval skin of the parasite, and whether it is an adventitious tissue of the host larva or a secretion of the parasite, or is explicable upon other grounds, I can not say. It is a point for some expert histologist to decide with fresh material which is not at hand at present.

An example of one of the inflating parasites in a thick-skinned host larva is shown in a coccinellid larva infested with *Homalotylus obscurus* m. The outlines of the parasitic cells are not so evident as in the *Lithocolletis*, but the host larva is very distorted and evidently contains these cells.

Species parasitic upon endophytous larvæ and, therefore, feeding externally, transform to pupæ close to the remains of the host in the burrow or leaf mine, usually attached at the anal end by the prepupal excrement. I have observed a curious variation in the case of *Chrysocharis*



*singularis* in the mine of *Lithocolletis hamadryadella* on oak leaves, which I have described in the American Naturalist for January, 1881. In this case the chalcidid pupa is surrounded by small excremental pillars arranged in an ellipse and connecting the roof and floor of the mine. It can not be stated whether the pillars are formed of regurgitated matter or of anal excrement, although the former hypothesis seems to be more probable. It is likely that such arrangements as this will be found frequently when the parasites of leaf-miners are carefully studied.

The internal parasites of externally-feeding larvæ also transform to outside pupæ in a few instances, as with the eulophine genera *Cratotelchus* and *Sympiezus*, and probably with other genera of this subfamily. These forms are common parasites of several large lepidopterous larvæ which feed on the leaves of oak in the United States. The host-larva affords food for a number of the parasitic larvæ and is almost entirely consumed by them. When ready to transform the parasitic larvæ crawl out upon the leaf, void their excrement and change to shapeless dark-colored pupæ nearly erect in position, the anal portion of the body being attached to the leaf by means of a small mass of light-colored excremental pellets. They seem preferably to station themselves in the form of an irregular ellipse about the remains of the host larva, each group consisting of from fifteen to forty individuals.

Scudder, in his "Butterflies of New England" (p. 455), gives a happy picture of the appearance of the pupæ of an undescribed species parasitic on the larva of *Vanessa atalanta*, in the following words: " \* \* And still another [parasite], a species of *Eulophus*, the coal-black chrysalides of which one may sometimes find to the number of twenty or more, standing erect on their hinder ends around the corpse they have destroyed, like tombstones in a cemetery, a most melancholy spectacle on opening a nest to get a young caterpillar." In correspondence with me Mr. Scudder has always referred to them as "my tombstone pupæ," and the term is an admirably descriptive one.

The chalcidid larvæ which feed externally on outside-feeding larvæ, and we know only one genus in which this habit uniformly prevails, spin a coarse rough silk, attaching the depleted skin of the host-insect to the leaf on which it had been feeding, and transform to pupæ, side by side, in a regular transverse row in the silky mass. Frequently the host larva has supported so many parasitic larvæ that their web attaches the entire shriveled skin from end to end; but, again, they do not occur in sufficient numbers to accomplish this result, and only half of the skin is thus fastened (Schwarz states that with the cotton worm and Comstock's *Euplectrus* it is usually the anterior portion), and the remaining portion hangs down, is doubled back, and breaks off.

The larvæ of the closely allied genus *Elachistus* pupate externally, but do not spin the loose silk characteristic of *Euplectrus*. I have seen the naked pupæ of *Elachistus cacæciæ* attached by their anal end to the silk spun in its leaf-roll by the larva of *Cacæcia rosaceana*, while the pupæ

of *E. spilosomatis* MS. are found attached in a group among the long hairs on the dorsum of the abdomen of the larva of *Spilosoma virginica*. In the allied genus *Miotropis*, *M. platynotæ* transforms without its host in the leaf-rolls of *Platynota rostrana*, as observed by Hubbard (Orange Insects, p. 153).

*Euplectrus*, although it spins silk, can by no means be said to form a cocoon, and therefore does not form a true exception to the rule that the pupæ are naked with the *Chalcididae*. The oft-repeated and hitherto accepted observation of Haliday, to the effect that *Coryna clavata* does spin a true cocoon, would, however, form a distinct and unexplained exception were it not for the fact that I fully believe the statement to have been unfounded. Haliday, in speaking of plant-louse parasites (Entom. Mag. II, 99), writes: "Some of these last [parasites of *Aphidius*] (*Coruna clavata* Walk., Ent. Mag. I, p. 386), not content with the covering which protects the *Aphidius* to its final change, when they are full fed leave the cavity and spin a white silky web between the belly of the Puceron and the leaf, and in this undergo their transformation."

This statement has been quoted by Westwood in his Introduction and by subsequent writers, and Buckton, in Vol. II of his Monograph of the British Aphides, gives a somewhat elaborate illustrated account of the cocoon-spinning of a species which he calls *C. dubia*. He figures one cocoon broken open and showing several shining black pupæ which he considers to be parasites of the *Coryna*. *Coryna*, it may be stated, is identical with the Pteromaline genus *Pachycrepis* of Foerster. Now cocoons precisely similar to those described by Haliday and figured by Buckton are found in this country. Miss Murtfeldt has found them under a rose aphidid in Missouri, and Dr. Riley tells me that he has seen them abundant under dead aphides upon his rose bushes in Washington. We breed from these cocoons here not *Pachycrepis* but the aphidiid genus *Praon*, and as it is quite out of the question that *Praon* should be hyperparasitic upon *Pachycrepis*, we may safely conclude that *Praon* makes the cocoon and that *Pachycrepis* (or *Coryna*) is a hyperparasite. It is more than likely that the several pupæ of the unknown secondary parasite figured by Buckton are those of *Coryna* itself, while the larva which he watched so carefully under glass and figured in the act of making its cocoon was undoubtedly braconid and not chalcidid. We have then no cases in which a chalcidid larva transforms to pupa within a true cocoon.

#### HOW MANY DEVELOP IN A SINGLE HOST?

The answer to this question is brief—from one to three thousand! With the larger species but one individual issues from a single host unless the latter is of extraordinary size. No more than one specimen of *Chalcis robusta* issues from the chrysalis of a swallow-tail butterfly, but with *Spilochalcis mariae*, a parasite of nearly equal size, Chambers reared 48 from a single cocoon of the large American Silk-worm *Telea pyralpha*.

*mus.* The number developing in a single host depends (*a*) upon the size of the host and (*b*) upon the size of the parasite. Six or eight specimens of a little *Copidosoma* will issue from the larva of a *Lithocolletis*, while, as actual count has demonstrated, over 2,500 specimens of a congeneric species of the same size will issue from the larva of a *Plusia*. The number varies in this instance from some cause from this down to something over a thousand. Between the extremes there is every gradation. Usually a single *Coccophagus* inhabits a single *Mytilaspis*, but from two to six specimens of *Coccophagus lecanii* issue from *Lecanium hesperidum*, while thirteen specimens of the same species have been reared from *Lecanium quercitrionis*. From two to four specimens of *Trichogramma minuta* will issue from a single egg of *Basilarchia ærhippus*, from three to eight specimens of *Homalotylus obscurus* from a single larva of *Megilla maculata*, from ten to thirteen specimens of *Bothriothorax peculiaris* from a full-grown larva of the syrphid genus *Allograpta*, from thirty to forty specimens of *Cratotechus basalis* from a larva of *Datana ministra*, or from 600 to 700 specimens of *Pteromalus puparum* from a single chrysalis of one of the larger butterflies.

No observations have been made bearing upon the number of eggs laid upon the host by the parent-parasite, and just how far the mother grades the number of eggs laid to the size of the host-insect is unknown. The probabilities are that she does regulate her oviposition in this way, but it is also probable that she somewhat overstocks each host, as Poulton has observed the Ichneumonid *Paniscus cephalotes* to do with *Dicranura vinula* and other large European larvæ (Trans. Ent. Soc. Lond. 1886, p. 162). A complication arises when we come to consider the very few cases of a very small chalcidid attacking a large host insect. I say the "very few cases," for it is a fact that as a rule these parasites do not attack insects which they can not completely stock with their egg supply. With the case of the genus *Copidosoma*, however, the parasite is exceedingly small and many of the host insects are large, as *Plusia* and other large noctuids. As just stated, over 2,500 specimens of *Copidosoma truncatellum* have been reared from one larva of *Plusia brassica*, and the eggs from which these parasites came must have been laid by several females, as in no case have I been able to count over 160 eggs in the ovaries of a *Copidosoma*. It is true that my methods of making this count have been rough. I have simply crushed the abdomen of living individuals under a cover glass in glycerine and forced out the ovaries under pressure, counting the eggs by means of the coördinated eye piece micrometer; but judging from my experience with the ovaries of larger insects, I have probably counted at least half. Probably, then, seven or eight females oviposited in this one *Plusia* larva, and also at the same time, as all larvæ developed together, and transformed together, and issued nearly together.

## PROPORTIONS OF SEXES IN ISSUING.

De Geer recorded the singular fact that male parasites alone were produced in considerable numbers from one leaf-rolling caterpillar and only females from another (*Mémoires*, I, 583), and on this as a basis Kirby and Spence (IV, 223) conjectured that the eggs producing the two sexes are arranged separately in the two ovaries. Unfortunately De Geer's observation has never been repeated, so far as I know, while multifarious instances are recorded in which individuals of both sexes have issued in varying proportions from the same host; and the proportions are very variable even with the same species. Westwood reared 20 males and 36 females of *Pteromalus puparum* from a chrysalis of *Vanessa urticae*, and Walker reared 82 males and 26 females of the same species from a single chrysalis. Riley has reared 25 ♀ and 28 ♂ specimens of the same parasite from a chrysalis of *Papilio turnus*, and 41 ♂, 39 ♀ from another. Scudder has reared 17 ♂, 108 ♀ from a chrysalis of *Basilarchia archippus*, and the same author has reared and counted over 2,000 from *Pieris rapæ* in France (*Butterflies of New England*, p. 1215). His experience with regard to the proportion of the sexes was as follows: "In almost all cases where the total number was very great, the males exceeded the females; as a whole the females averaged a little over 35 to a little over 25 males, and in only one-third the instances where the number of the females fell below the average the males outnumbered them. The most excessive case was 84 males to 12 females, or 7 to 1." Of the same parasite Webster (*Insect Life*, I, 225) records a rearing of 68 ♂, 4 ♀ specimens from a chrysalis of *Pontia protodice*.

With other species counts have not been so frequent. Scudder reared 9 ♂, 70 ♀ specimens of *Trichogramma minutissimum* from five eggs of *Papilio glaucus*. Riley reared 12 ♀, 8 ♂ of *Podagrion mantis* from a single egg case of *Stagmomantis carolina*, and the notes of the Division of Entomology show 14 ♀, 1 ♂ of the same species from another egg case of the same host.

Other isolated counts like this could be made in number from the biological collection of the National Museum, but would accomplish nothing beyond showing an extreme variability in the proportions of sexes. Could we have an accumulation of counts of the same parasite affecting the same host, with coördinate observations such as are indicated by Scudder in his remarks on *Pteromalus puparum*, interesting results could without doubt be obtained. His statement, for instance, that in almost all cases where the total number was very great the males exceeded the females and the reverse, is well worth thought and the labor of verifying it and conducting many additional counts, for it apparently affords a new argument to the few who still contend that sex is influenced by larval food. The numerical relationship is, however, probably insignificant, and the cases in which the males so greatly preponderate are probably to be explained on the ground that these

are the offspring of nonfecundated females. (See section on parthenogenesis.)

As to the relative time of the issuing of the sexes, it has been my general experience that the males issue before the females and await the appearance of their mates, just as is so often noticed by rearers of Lepidoptera and Coleoptera and as Harrington has shown in the ichneumonid genus *Thalessa* (*Canadian Entomologist*, November, 1887). A single instance may suffice to illustrate this point. My original breeding record of *Pentacladia bucculatricis* shows that May 19 there issued 5 ♂, no ♀; May 20, 7 ♂, 1 ♀; May 21, 3 ♂, 8 ♀, and May 22, no ♂, 12 ♀. So well marked is this that when a new-reared chalcidid is brought to me from a host insect of which there is a plentiful material in our breeding cages I anticipate a great preponderance of males, and look forward to the next day or two to bring a supply of females. With this in view Mr. Scudder's contradictory experience with *Pteromalus puparum* is strange. He writes (*loc. cit.*): "In some instances the entire brood would emerge in a single day; at others the bulk would emerge the first day and others would straggle out one after another for a week or more; sometimes again they would come out daily or almost daily for several weeks, as in one instance from February 24 to March 14; and in another, the most extended, from March 18 to April 28. Males and females seem to be equally early and late."

Confirmatory of my own experience and contradictory to Mr. Scudder's is the statement of Adler, in whose extensive rearings of this parasite from the chrysalids *Vanessa io*, *V. polychloros*, *V. urticae*, and *Pieris rapæ* the males regularly appeared first.

As so much attention has been given in this section to *Pteromalus puparum*, I may advert to Brischke's statement (D. Ichn. d. Prov. West. u. Ost-Preussen, II Fortsetzung, p. 125) that this species, when infesting *Pieris brassicæ*, *Rhodocera rhamni*, *Vanessa urticae*, and *V. polychloros*, is hyperparasitic. There can be no doubt but that this statement is a grave error, and it is inconceivable that a man of Brischke's care could have been responsible for it. I prefer to believe that it was simply a printer's error in underscoring this species. (All species underscored are indicated in a footnote to be parasites of parasites.)

#### PHYTOPHAGIC HABIT.

Ever since Nees v. Esenbeck, in 1834 (Hym. Ichn. Aff., 415), made the statement that his *Eurytoma rosæ* was the maker of the galls on *Rosa centifolia*, the parasitic or vegetal-feeding habit of certain eurytomines has been under dispute among entomologists.

Since the publication of Mayr's able paper, "Arten der chalcidier-Gattung Eurytoma," in 1879, there has been no doubt about the habit of the Neesian species, for it is shown to be a common parasite on the makers of no less than 56 different European cynipid galls. Even as late as 1871, however, Walker (Notes on Chalcidæ, p. 11) considers

Nees's observation as "proof that the *Eurytomæ* are not all parasitic," and goes on to say: "Whether one species of this family is sometimes parasitic on other insects and sometimes herbivorous, and has thus the choice of two ways of perpetuating its existence, has yet to be ascertained."

The lengthy discussion, extending over many years, concerning the true habit of the American Joint Worm (*Isosoma hordii*), and how even after the proof of its phytophagic habit adduced by Harris, Fitch, and Walsh (the latter changing from the wrong to the right side of the question after ascertaining the generic distinction of the Joint Worm from *Eurytoma*), the fact was still not accepted by many European entomologists as late as 1882 need not be elaborated here—it is common information to all American entomologists. Since the publication of Riley's articles on *Isosoma tritici* and the admirable summary of the entire subject by the veteran Westwood (Trans. Entom. Soc. Lond., 1882, 307–327) no word of opposition has been advanced to the conclusion that *Isosoma* at least is phytophagic.

In the early consensus of European opinion against the views of American entomologists on this important point, however, we must not lose sight of the fact that three Dutch observers, Ritsema, Weyenbergh, and Snellen von Vollenhoven, had at least as early as 1870 proven that a gall on beach grass (*Ammophila arundinacea*) was produced by *Eurytoma* (?) *longipennis*, the first observation having been made by a brother of H. Ritsema in 1867. (See Archives Neerlandaises des Sciences Exactes, v, 1870, and Tijdschrift voor Entomologie, Second Series, VI, 1871, pp. 148.) This species is probably not a *Eurytoma*, but an *Isosoma*, although I can find no published statement to this effect. It is not included by Mayr, however, among the species of *Eurytoma*.

The grape-seed feeders formerly placed in *Isosoma* belong to *Evoxy-soma* Ashm., and unpublished notes of the Division of Entomology show that *Eurytomacharis* Ashm., *Isosomorphia* Ashm., and *Philachyra* Hal., are also gall-makers. (The type of the last named genus was found in straw roofs near Lucca, Italy). These three genera are, however, much more closely related structurally to *Isosoma* than to *Eurytoma*, *Decatoma*, or other eurytomine genera. Others of Ashmead's recent genera resembling *Isosoma* will probably also be found to have the phytophagic habit.

As before mentioned, the habit of *Eurytoma* has been questioned by Walker largely on the strength of Nees's observation. Westwood (*loc. cit.*) says of his Ceylonese *Eurytoma taprobanica*, "I have but little doubt that this beautiful species is the real maker of the gall (on *Ficus*) from which specimens of both sexes have been reared." No good proof, however, has ever been advanced to show that *Eurytoma* proper is ever anything but parasitic, while the possible hypothesis that it may be inquilinous in the gall from which it is so abundantly reared is to a great extent disproven by my observations on *Eurytoma prunicola*, larvæ of

which I have observed to feed on the larva of *Cynips quercus-prunus*, subsequently rearing the identical *Eurytoma* larvæ to the adult. (Proc. Ent. Soc. Wash. 11, pp. 66, 67.) This same observation has still to be made on other eurytomine genera, and would be particularly important with *Decatoma*.

But one other claim of phytophagic habit in a chalcidid has been made, so far as I know. Wachtl (Wiener Entom. Zeit., 1884, pp. 38, 39) claims to have proven that the torymine *Megastigmus collaris* Boh., is a vegetable feeder and not zoöphagous, feeding within the seeds of roses upon their kernels. A careful perusal of the details of this observation (and he claims the same for *Megastigmus pictus* also) does not satisfy me of the correctness of his conclusion. I have found the larva of *Eurytoma funebre* in the seeds of clover, in which they had been feeding on the larvæ of *Cecidomyia leguminicola*, when the dipterous larva had been entirely devoured, and yet I knew the *Eurytoma* to be a parasite of the *Cecidomyia* from other observations. I am of the opinion that the *Megastigmus* will in the same way be found to have destroyed some original occupant of the seed. Phytophagic Chalcididæ are therefore confined to *Isosoma* and *Isosma*-like forms among the *Eurytomina*.

#### PARTHENOGENESIS.

The phenomenon of parthenogenesis is now known to occur commonly with representatives of four families of Hymenoptera: *Apidae*, *Tenthredinidæ*, *Cynipidæ*, and *Chalcididæ*, and will doubtless be much more generally found than is at present supposed.

The first observation to this effect among the *Chalcididæ* was made by Adler in 1876, and is thus described by him:

In the spring of 1876 I had collected a number of chrysalids of *Pieris brassica* which were stung by *Pteromalus puparum*. At the same time I had reared some larvæ of *Vanessa urtica* which pupated in June.

I caused these chrysalids to be pierced by nonfecundated females of *Pteromalus*. To be sure of my fact I had even taken the precaution after the egg laying to examine the *receptaculum seminis*, and I know with certainty that fecundation had not taken place. The parasitized chrysalids gave me the following results:

First chrysalis.....	124 ♂	0 ♀
Second chrysalis.....	62 ♂	0 ♀
Third chrysalis.....	75 ♂	5 ♀
Fourth chrysalis.....	45 ♂	4 ♀
	<hr/>	<hr/>
	306 ♂	9 ♀

This single observation renders it probable that the females of *Pteromalus* frequently reproduce without having been fecundated, but it is only one of several similar cases tried by Dr. Adler, who says concerning them: "I have often made these trials, and the results have generally been that virgin females gave birth ordinarily only to males." The agamic generation is then usually accidental and not self-perpetuating; and its occurrence with this species is either the beginning of an alternation of generations, or on the theory upheld by Adler in the *Cynipidæ* a surviving trace of an early complete and total parthenogenesis.

Among the *Chalcididae* probably the closest allies to the *Cynipidae* are to be found in the subfamily *Eurytominae*, and it is consequently here, if anywhere in the family, that we should expect to find an alternation of generations. And such is indeed the case. Although this highly important discovery has not apparently become generally known among entomologists, it has been a matter of record more than five years that *Isosoma tritici* and *I. grande* are dimorphic forms of the same species and that they regularly alternate, *I. tritici* being the hibernating sexed generation and *I. grande* the agamic summer generation. These conclusions and the facts from which they are deduced are published in Riley's report as Entomologist of the U. S. Department Agriculture, 1886, pp. 542-544.

From the proof of agamic reproduction in these two cases a great field of investigation is opened up, which is biologically of the highest interest and importance.

#### HOW LARGE IS THE FAMILY ?

No conception of the richness of the family *Chalcididae* in number of species can be gained from any statements which have appeared in print. The systematic study of the group is but just begun. The British Museum Catalogue in 1846 recorded 1,094 species from all parts of the world, while Kirchner in 1867 recorded 2,407 described species from Europe alone. Kirchner's catalogue, however, is not synonymical, and it is certain that it contains a very large number of synonyms. In the genus *Pteromalus*, for instance, are recorded 630 species, and it is not likely that more than half of these are valid. In this country (America north of Mexico) the latest list (Cresson's, 1887) records only 413 species, while I have recorded (Bull. v, Div. Ent.), in addition to these, 128 species from Mexico and the West Indies. For the purposes of this paper I have gone carefully over the collection of the National Museum, and estimate the number of species of this family contained in that one collection at something over 2,000, nearly all from America north of Mexico. According to my best judgment this represents a very small proportion of the species yet to be found within these geographical limits, as almost no effort at general collecting has been made and these 2,000 species are very largely the result of accidental breeding. When a single sweep of the beating net on the Department grounds at Washington will result in the capture of five new species, what will be the result when the entire country shall have been collected over by sifting, beating, and the many other devices known to experienced collectors? I fully believe that to estimate the number of species of this one family in North America as exceeding the number of described North American species of the entire order Hymenoptera, would be far below the truth. When we consider, as shown in a previous section, that these small hymenopterous parasites live upon or within some one or several of the stages of perhaps the majority of insects of



all orders, then we no longer wonder at their great numbers or at the great variety exhibited among them.

The family *Chalcididæ* will, in my opinion, prove to be by far the largest of the 40 odd families of Hymenoptera, with the *Braconidæ* second, the *Ichneumonidæ* third, and the *Proctotrypidæ* fourth, and there is little doubt in my mind that the immense numbers of undescribed species in three of these families will eventually place the Hymenoptera numerically above every other order of insects.

# A CRITICAL REVIEW OF THE CHARACTERS AND VARIATIONS OF THE SNAKES OF NORTH AMERICA.

BY

E. D. COPE.

In the following paper the attempt is made to define with precision the species of North American snakes, together with their variations. This may be done more satisfactorily than hitherto, since the material which has accumulated in our museums is now considerable. In making this investigation I have had the advantage of a full study of the specimens in the U. S. National Museum,\* as well as those in other collections.

So soon as sufficient material becomes available, the zoologist can make that kind of research into the permanency and variability of the characters of species which characterizes the exact stage of the science. It is on such study that all useful conclusions as to the origin of species depends. It is not the orderly relation of species and genera to each other that demonstrates the truth of the hypothesis of the derivation of species, but the knowledge of their variations. Moreover, the beginning of all investigation into the causes of those variations is the knowledge of the direction which they take, whether they are promiscuous or whether they bear some definite relation to each other or to the environment.

This being the object of this paper, I have not entered into any discussion of systematic problems.

## I.—CATODONTA.

### GLAUCONIA Gray.

Catalogue Lizards Brit. Mus., 1845, p. 139. *Stenostoma* Wagl., Nat. Syst. Amphib., 1830, nec Latreillei, 1810 (Coleoptera). *Leptotyphlops* Stejneger, Proc. U. S. Nat. Mus., 1891, 501 (after Fitzinger, *nomen nudum*).

Head slightly depressed and continuous with the body. Snout blunt and rounded, overlapping considerably the lower jaw. A large rostral plate. One nasal. A pair of frontonasals. One ocular shield, which extends to the labial border. A pair of superciliaries, parietals and

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\*I wish to express here the obligation under which I have been placed by the officers of that institution, Profs. S. P. Langley and G. B. Goode.

postparietals, all scale like. Medial row of scales extending over the head to the rostral. Nostrils lateral, oblong, situated between the nasal and fronto-nasal. Eyes covered by continuous epidermis.

This genus is found throughout tropical Africa and America, and it embraces a considerable number of species in all the faunal regions of the latter. These are of subterranean habits, which are little known. Some of them are said to inhabit ants' nests. One species is known from India.

***Glauconia dulcis* Bd., Gird.**

*Rena dulcis* Bd. & Girard, Catal. Serp. N. A., 1853, p. 142. *Stenostoma dulce* Peters Monatsber., Berlin Akad., Wis., 1857, p. 402; Cope, Proc. Academy Phila., 1861, p. 305; Jan. Icon., Gen. Oph. 1, vol. 2, Fig. 5. *Stenostoma rubellum* Garman, Memoirs Mus. Comp. Zoology, Cambridge, viii, 1883, p. 130; teste Stejneger.

This species ranges from central Texas to the Red River on the east to New Mexico, inclusive, on the west, and southward along the Rio Grande in Texas as far as San Antonio.

**RENA** Baird, Girard.

Cat. Rep. N. A., Pt. 1, Serpents, 1853, p. 142; Cope, Proc. Amer. Philo. Soc., 1886, p. 481. *Catodon* Dum. & Bibron, Er. Gen., vi, p. 318, 1844, not of Artedi. *Siagonodon* Peters, Gesellsch. Naturforsch. Freunde, Berlin, 1881, p. 71.

Similar to *Stenostoma*, but the superciliary scales are absent.

***Rena humilis* Bd., Gird.**

Cat. Rep. N. Am., 1, Serpents, p. 143. *Stenostoma humile* Cope, Proc. Acad. Phila., 1861, p. 305; Check List, Batr. & Rep. N. A., 1875, p. 44.

Lower California, southern California, and southern Arizona.

## II.—ASINEA.

### BOIDÆ.

The only genus of Boidæ which is known to enter the boundaries of the Nearctic Realm is *Lichanura*. It is possible that the *Boa imperator* has been seen in the valley of the Lower Rio Grande, but of this positive evidence is as yet wanting. This species, the *Epicrates angulifer* of Cuba, and the *Ungualia pardalis* of Jamaica are occasionally introduced into the country in bunches of bananas. The serpent winds itself tightly around the stem, and is concealed from view until the fruit is being removed. Unless of large size, these snakes are harmless.

**LICHANURA** Cope.

Proc. Acad. Phila., 1861, p. 304; Bull. U. S. Nat. Mus., 32, 1887, p. 50.

General form abbreviated and stout; tail short, slightly prehensile, obtuse at the extremity. Head slightly distinct; eye small, pupil vertical. Nostril between two plates, the anterior in contact with that of the opposite side upon the median line. Frontonasal suture extensive.

Posterior to these, the upper surface of the head is covered with smooth scales. Labial plates without pits. Scales smooth, broad, poreless. Spurs conspicuous. Gastrosteges narrow.

In this genus the tail is less prehensile than in *Boa*, but is more so than in *Eryx* and *Charina*. It also differs externally from the latter genus (with which Garman at one time proposed to unite it) in the absence of the frontal plate and the parietals adjacent to it. An important osteological difference is the presence of the coronoid bone, which is wanting in *Charina*.

The species of this genus are variable in their details both as to squamation and coloration. I distinguish three species. Dr. Stejneger has named another, which he subsequently withdrew. In his latest study of this genus this author distinguishes the species as follows:

A. Eye large; its diameter more than one-third distance from anterior canthus to tip of muzzle; gastrosteges about 218.

Whitish with three blackish brown longitudinal bands in strong contrast. *L. trivirgata*

AA. Eye smaller; its diameter one-third or less the distance from anterior canthus to tip of muzzle; gastrosteges 224 to 241.

Color brownish or bluish above, with or without longitudinal bands, which when present contrast but little with the ground color; true loreals 3; scale rows 39-43; rostral not prominent..... *L. roseofusca*

Color as in *L. roseofusca*; true loreals 2; scale rows 35; rostral prominent. *L. orcuttii*

*Lichanura trivirgata* Cope.

Proc. Acad. Phila. 1861, p. 304; Bocourt, Miss. Sci. de Mexique, p. 573; Stejneger, Proc. U. S. Nat. Mus., 1889, p. 98; 1891, 514; *Charina trivirgata* Garman, Mem. Mus. Compar. Zool. Cambr., VIII, 1883, 136.

The coloration of this handsome *Boa* is altogether unique in the family. It calls to mind the *Salvadora* of the same region. It inhabits the southern part of Lower California, where Messrs. Xantus and Belding have obtained it for the Smithsonian Institution. They found it in swamps among the mountains.

No. 12602: 40, 14: 215 + 1 + 44: 582, 96 mm.

*Lichanura roseofusca* Cope.

Proc. Acad. Phila., 1868, p. 2; Stejneger, Proc. U. S. Nat. Museum, 1891, p. 514; *Lichanura myriolepis* Cope, Proc. Acad. Phila., 1868, p. 2; Stejneger, Proc. U. S. Nat. Mus., 1889, p. 96; *Lichanura simplex* Stej., l. c., pp. 95, 96.

A variety of this species is represented by a specimen (No. 14129) from San Diego, Cal. The color above as far as the fifth row of scales on each side is a brownish lead color; below this line and on the lower surfaces light lead color with dark lead-colored borders to some of the scales, and a wide lead-colored basal band of the gastrosteges and urosteges. There are three longitudinal rusty brown bands on the dorsal region, which are indistinctly defined, and of irregular width. No. 14129: 42, 14; 229, 49; 788, 115.

It was on a specimen of this variety from the same locality that I proposed the species *Lichanura myriolepis*. It has forty-three rows of scales. Another specimen from San Diego is described by Dr.

Stejneger as a distinct species under the name of *L. simplex*. It has forty rows of scales, and there are no longitudinal stripes above, the general color above being brownish drab, below whitish; gastrosteges 232, urosteges 39. Eye encircled by 7-8 scales. These forms graduate into the *L. trivirgata*, both in color and in number of scale rows. The number of gastrosteges is larger, but I suspect that this character is not constant.

*Lichanura orcuttli* Stejneger.

Proc. U. S. Nat. Museum, 1889, p. 96; 1891, p. 514.

San Diego, California.

CHARINIDÆ.

CHARINA Gray.

Gray, Cat. Snakes in the Brit. Mus., 1849, p. 84; Cope, Bull. U. S. Nat. Mus. 32, 1887, p. 51; *Wenona* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 139; Bocourt, Miss. Sci. Mexique, 1882, p. 511. *Pseuderyx* Jan, Archiv. f. Naturgesch. 1862, v. 1, p. 242; Elencos Sistem, 1863, 19.

Nostril between postnasal and prenasal, the latter confluent with the internasal. Two pairs of prefrontals, a frontal, and rudimentary parietals. Pupil vertical. Scales of body smooth. Tail short, obtuse, not prehensile, and spurs exserted.

Prenasal separated from internasal; postnasal joining preocular; prefrontal entering orbit; one superciliary; superior labials 8-9..... *C. brachyops*.  
Postnasal plate separated from preocular; prefrontal not entering orbit; more than one superciliary; prenasal fused with internasal; superior labials 9-11... *C. bottæ*

*Charina brachyops* Cope.

Proc. U. S. Nat. Mus., 1888, p. 88, Pl. xxxvi, Fig. 2; Stejneger, *loc. cit.*, 1890, 179.

Point Reyes, California.

*Charina bottæ* Blv.

Gray, Cat. Snakes in Brit. Mus., 1849, p. 113; Cope, Check List Batr. Rep. N. Am., 1875, 43; *Tortrix bottæ* Blainville, Nouv. Ann. Mus. Hist. Nat., Paris, III, 1834, p. 57; *Pseuderyx bottæ* Jan, l. c., Fig. 1; *Wenona plumbea et isabella* Bd. and Gird., Cat. Serp. N. Am., 1853, pp. 139-40; Jan, Icon. Gen. Oph., 1, 3, ii, Fig. 2; Bocourt Miss. Sci. Mex., 1882, p. 512, pl. xxx, Fig. 7.

The extraordinary variability of this species in the squamation of the head may be exhibited in the following table :

I. Internasals confluent with prefrontals.

Loreal present; eye resting on labials; No. 4496, No. 9563.

II. Internasals distinct.

A. Rostral separating internasals on the middle line.

Loreal present; eye on labials on one side; separated by scales on the other;  
No. 4497.

AA. Rostral not separating internasals.

B. Eye resting on labials.

Loreal present; Nos. 4497, 11691, 11789, 12581,

No loreals; No. 7299.

BB. Eye resting on labials on one side, and not on the other.

Loreal present, No. 4494.

BBB. Eye separated from labials on both sides.

Loreals, one on one side, two on the other, 8922.

Loreals, one on each side, 9255.

Loreals, none, 4492.

None of the North American specimens have the internasals separated on the middle line by a scale, as is stated to be the case in the type of *C. bottæ* by Bocourt. Several have the prefrontals separated by scales, however, so that the character of the type specimen is probably only an individual variation. There is no reason to suppose that the Upper California species differs from that of Lower California. I give the following notes which I took from De Blainville's type in the Museum of the Jardin des Plantes in 1864, by permission of Prof. Auguste Duméril: "The tail enters the total length  $9\frac{1}{2}$  times. Frontal much wider than long, postnasal and loreal longer than wide. One preocular. Ten superior labials: second and third touching loreal; fourth, fifth, and sixth entering orbit. Forty-three rows of scales, size graduating smaller from first to third. A reddish tint in the pale brown of the belly; above slaty brown." The specimen agreed in size and character with the one described by De Blainville, and I am therefore at a loss to understand the accounts given by Jan and Bocourt. The former says\* there are but thirty-nine rows of scales on the body, and the latter says, perhaps by a typographical error, 29. Bocourt also says that at the period of his writing, 1882 (Mission Sci. de Mexique, 512), the specimen was no longer in good condition. It was in good condition at the time of my examination in 1864.

The *Wenona isabella* does not appear to me to differ specifically from the other forms. Its head plates display a peculiarity which is also seen in a specimen from California. (See table above).

This species ranges throughout the entire Pacific district, as well as the Lower Californian. The most eastern point from which the Smithsonian Institution has procured specimens is the John Day River, Oregon. It has been also obtained in the Great Basin, on the Humboldt River, Nevada.

## COLUBRIDÆ.

### CHILOMENISCUS Cope.

Proc. Acad. Phila., 1860, p. 339. Bull. U. S. Nat. Mus. No. 32, 1887, p. 53. *Bergenia* Steindachner, Voyage of the Novara, v, 1876, p. 92.

Form stout, body cylindrical, the head not distinct. Muzzle rounded, very prominent, and much depressed. Rostral plate large, with an extensive superior surface and presenting an obtuse angle between the prefrontals; the inferior surface greater than the superior, owing to the backward position of the mandible. Head shields broad, normal, except

\* Archiv. f. Naturgeschichte, 1862, i, p. 242.

in the confluence of the prefrontals with the nasals. Loreal none. One pre-, two post oculars. Scales smooth. Tail short, the urosteges and anal plate divided. Teeth equal or the posterior a little stouter. Palatine and pterygoid teeth present.

This truly calamarian genus is analogous to *Stenorhina* in the union of the nasal and prefrontal shields; and perhaps the form of the muzzle and inferior position of the mouth indicates affinity to *Chionactis*.

There are three species, which differ as follows:

I.—*Rostral plate very prominent.*

Postnasal reaching preocular; numerous black cross-bands which reach the gastroteges ..... *C. ephippicus*.

Postnasal not reaching preocular; light, with punctæ or cross-bands.... *C. stramineus*.

II.—*Rostral plate less prominent.*

Postnasal reaching preocular; reddish brown above, dirty yellow below; larger. *C. mexicanus*.\*

*Chilomeniscus ephippicus* Cope.

Proc. Acad. Phila., 1875, p. 85. Cope, Check List, N. Am. Batr. Rept., 1875, p. 35; Cones U. S. G. G. Surv. W. 100th Mer. v, p. 625. Pl. XVIII, Fig. 3. *Carphophis cinctus* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 166.

Nevada, Arizona.

*Chilomeniscus stramineus* Cope.

Proc. Phila. Acad., 1860, p. 339. Check List N. Am. Batr. Reptilia, 1875, p. 35.

Scales in thirteen rows, all wide and obtuse, four rows on each side, wider than long. Rostral plate extensively recurved on the superior surface of the muzzle, its posterior border presenting an obtuse angle. Internasals and prefrontal median suture short; frontal wide, but not as wide as long, angulate in front, more strongly angulate behind. Each parietal but little if any longer than the frontal. Prefrontal in considerable contact with second superior labial. Seven superior labials all longer than high except the first. Temporals 1 – 1, both deeper than long. Eyes and superciliary plates very small. Tail short and conical.

There are three color varieties of this species as follows:

Body annulate, with complete black rings..... *C. s. cinctus*.

Body with black cross-bands, which reach the first and second rows of scales.

*C. s. fasciatus*.

Scales with a median brown dot within the apex; no bands..... *C. s. stramineus*.

*Chilomeniscus stramineus cinctus* Cope.

*Chilomeniscus cinctus* Cope, Proc. Acad. Phila., 1861, p. 303; Check List N. Amer. Batr. Reptilia, 1875, p. 35. *Carphophis cinctus* Garman, Mus. Comp. Zool. Cambr., VIII, 1883, p. 166.

Sonora.

\* *Bergia mexicana* Steindachner Voyage of the Novara, 1876, p. 92, fig. (no number).

*Chilomeniscus stramineus fasciatus* Cope.

*Chilomeniscus cinctus* Cope, Yarrow Check List N. A. Batr. and Reptilia, 1883, p. 86.

There are no differences between this subspecies and the typical *C. s. stramineus* to be detected in the squamation, but the coloration differs to an extraordinary degree, resembling that of the *C. ephippicus*. Two specimens are in the National Museum collection: one of these has twenty-four and the other twenty-six black cross-bands on a white ground. Of these four in one and five in the other are on the tail. They are two scales long and eleven and two half scales in width; the spaces between them are two and a half scales long. There is a black patch on the head from the middle of the frontal to the posterior border of the occipital shields. No dark color on any of the under surfaces. No punctæ on the scales. No. 12,630; 13, 7: 108+1+26: 235, 33 mm.

*Chilomeniscus stramineus fasciatus* Cope.

Catalogue No.	No. of specimen.	Locality.	When collected.	From whom received.	Nature of specimen.
12,630	2	La Paz, Cal. ....	Feb. —, 1882.	L. Belding.	Alcoholic.

*Chilomeniscus stramineus stramineus* Cope.

*Chilomeniscus stramineus* Cope, Proc. Acad. Phila., 1860, p. 339. *Carphophis stramineus* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, 166.  
Lower California.

**STILOSOMA** Brown.

Proc. Phila. Acad. Nat. Sci., 1890, p. 199.

Body slender, cylindrical, and rigid; tail short; head rounded on frontal outline, not distinct from body. Rostral prominent, but not recurved; no internasals, anteorbitals, or loreals. One nasal. Prefrontals and parietals in contact with labials. Scales smooth. No scale pits. Anal entire. Teeth smooth.

This genus belongs to the type of *Rhabdosoma* D. and B. and *Carphophiops*, approaching nearest to *Geophidium* Pet. in the absence of internasal plates. It exhibits, however, a greater reduction than in that genus in the absence of loreal and preocular plates. Only one species is known.

*Stilosoma extenuatum* Brown

Proc. Phila. Acad. Nat. Sci., 1890, p. 199.

This curious species has the coloration of the type of *Hypsiglena* or *Sibon*. It is of great rarity, the type specimen found near Jacksonville, Fla., being the only one known. Its habits are probably subterranean.



**CARPHOPHIOPS** Gervais.

Dict. Hist. Nat. Univers. par D'Orbigny III, p. 191, 1843; Cope, Proc. Acad. Phila., 1860, p. 78; *Celuta* Bd. and Gird. Cat. Serp. N. A., 1853, p. 129. *Carphophis* Duméril Prodrome Class. Rep. Ophid., 1853, 43-46; Erp. Gen., VII, 1854, p. 131; Günther, Cat. Col. Snakes, Brit. Mus., 1858, p. 17.

Head depressed, continuous with the body. Cephalic plates normal, sometimes no distinct internasal plate. One nasal, nostril in the middle. No anteorbital; loreal entering orbit. Scales smooth, pitless. Postabdominal scutella bifid. Subcaudals divided.

This genus is the North American representative of the Neotropical *Rhabdosoma* and *Elapoidis*, the typical forest-burrowers. The species are generally found under and in rotten logs, and under the bark, where they readily make their way, forcing their sharp muzzle into narrow places with much muscular strength.

*Carphophiops* has exactly the plate and scale formula of *Abastor*.

The two species of the genus differ as follows:

Temporal scales 1-2; light color of belly not extending to third row of scales.

*C. amœnus*.

Temporal scales 1-1; light color of belly extending to third row of scales; back darker . . . . . *C. vermis*.

***Carphophiops amœnus* Say.** •

Cope, Proc. Acad. Phila., 1860, p. 78; *Coluber amœnus* Say, Journ. Acad. Phila., IV, 1825, 237; Storer, Rep. Mass., 1839, 226; *Calamaria amœna* Schlegel Essay Phya. Serp., 1837, 31; Pl. I, Figs. 19, 20. *Brachyorrhos amœnus* Holbrook N. Amer. Herpetal., III, 1842, 115, Pl. XXVII. *Celuta amœna* Bd. and Gird. Cat., 1853, p. 129. *Carphophis amœna*. Dum. Bibr. Erp. Gen., VII, 1854, p. 132; Günther, Cat. Col. Snakes Brit. Mus., 1858, p. 17; Jan Icon. Gen. Oph. I, 12, II, Fig. 4; *Celuta helenæ* Kennicott, Proc. Acad. Phila., 1859, p. 100.

In nearly half the specimens the internasal scuta are wanting. This condition was supposed by Kennicott to indicate a distinct species (*C. helenæ* Kenn.) and by some others, a distinct genus. There is, however, no other character by which to separate it from the *C. amœnus*, and the character itself is not constant. Thus in jar No. 8840 from Union County, Tenn., one specimen has both internasals, a second has but one, and a third is without any. In jar No. 12046 from Mount Carmel, Ill., nearly all the specimens lack the internasals, but one of them has the plate on one side.

Some other variations occur. Thus in a specimen from Jackson, N. C., (No. 1921), the anterior angle of the frontal plate is produced forwards to the internasals completely separating the prefrontals. In No. 10721 from Washington, D. C., there is but one, a large scute, in the second row of temporals, and two rows of scales are of the color of the abdomen, which contrasts strongly with that of the dorsal regions. The specimen is quite intermediate between this species and the *C. vermis*. In some specimens the superciliary is larger than the postocular; in others the reverse is the case. 1925: 13.5: 127+1+32: 260, 46<sup>mm</sup>.

**Carphophiops vermis** Kenn.

Cope, Check List Batr. Rept. N. Amer., 1875, p. 34. *Celuta vermis* Kennicott, Proc. Acad. Phila., 1859, p. 99.

The distribution of this species is in the southwestern part of the eastern region.

**TANTILLA** Bd. Gird.

Cat. Serp. N. A., 1853, p. 131; Cope, Journ. Acad. Phila., 1875, p. 143; Bull. U. S. Nat. Mus., 32, p. 52, 1887; *Homalocranium* Dum. Prodrome Class Rept. Ophid., 1853, p. 94; Günther, Cat. Col. Snakes B. M. 1858, p. 18.

Head depressed, continuous with the body. Cephalic plates normal. Internasals and prefrontals two each. Posterior maxillary tooth grooved. Two nasals, nostrils in the anterior plate. No loreal. Anterior orbital one; posterior one or two. Eyes below the medium size. Body subcylindrical; tail short. Scales smooth. Postabdominal scutella bifid. Subcaudals all divided.

This genus is distributed throughout the Neotropical Realm excepting the West Indian Region, Trinidad excepted. Its species are especially abundant in the Central American district. Three species are found in the Nearctic Realm. They differ as follows:

**I. Superior labials six; orbitals 1-1**

Muzzle produced; preorbital not in contact with superciliary nor nasal; three longitudinal bands..... *T. calamarina*, Cope.

Muzzle less produced; preorbital in contact with superciliary and nasal; temporal one; three bands..... *T. bimaculata*, Cope.

Temporals two; no bands..... *T. gracilis*, Bd. and Gird.

**II. Superior labials seven; orbitals 1-1.**

Coloration uniform..... *T. planiceps*, Blainv.

**III. Superior labials seven; two postorbitals.**

A. Postnasals in contact with preocular, or nearly so.

B. Posterior labials elevated, separated from parietals by one temporal.

From slender; a yellow black bordered collar near parietal plates; below red.  
*T. miniata*, Cope.\*

BB. Posterior labials elevated, bounded above by two temporals (longitudinally).

Urosteges 68; head black with yellow collar; body brown with three yellow stripes..... *T. taniata*, Boc.

Urosteges 55-63; labials higher; first inferior labials separated; black everywhere, with yellow collar..... *T. moesta*, Gthr.

Urosteges 37; black above, with yellow collar; yellowish below.

*T. schistosa*, Boc.

Frontal narrower; posterior labials higher, body light, dark banded.

*T. melanocephala*, Linn.

Frontal wider; posterior labials lower; body uniform red.... *T. rubra*, Cope.

BB. Posterior labials lower, bounded above by two temporals (longitudinally).

C. Inferior labials of first pair in contact on the middle line.

Postnasal very small; collar far behind head; body banded; urosteges 51.

*T. armillata*, Cope.

Postnasal large; collar crossing parietal scute; body unicolor; below whitish; urosteges 35..... *T. coronata*, Bd. and Gird.

\**Homalocranium deppei*, Boc. Miss. Sci. Mex., 1883, p. 584, pl. xxxvi, f. 11.

## CC. Inferior labials separated by symphyseal.

Urosteges 67; postnasal large, bounded below by first labial; a yellow collar.  
*T. reticulata* Cope.

Urosteges 57; postnasal chiefly bounded by second labial; head black, no collar.....*T. nigriceps*, Kenn.

Urosteges 39; first labial rising to nostril; head and body uniform.  
*T. canula*, Cope.

Urosteges 25; nasals not interrupted by first upper labial; head dark with a pale occipital spot.....*T. vermiformis*, Hallow.

## AA. Postnasals separated from preocular by a wide space.

Urosteges 57; unicolor, pale; top of head and collar black.

*T. pallida*, Cope.

Urosteges 66; last upper labial larger than sixth; body above with black and white half-rings.....*T. semicincta*, D. and B.

**Tantilla gracilis** Bd. and Gird.

Cat. Serp. N. Amer., 1853, 132; Cope Check List, 1875, p. 35; *Homalocranium gracile* Bocourt Mission Scient., Mexique 1883, p. 579, Pl. xxxvi, Fig. 5; Jan, Icon. Gen. Ofid. i, 15 ii, Fig. 1. *Tantilla hallowellii* Cope, Proc. Acad. Phila. 1860, p. 77.

The postnasal and preocular plates are sometimes separated in this species. On such a specimen the *T. hallowellii* was proposed.

Western Texas.

**Tantilla planiceps** Blainv.

Cope, Jour. Acad. Phila., 1875, p. 143; *Coluber planiceps* Blainville, Amer. Mus. Hist. Nat., Paris, iii, 1834, p. 62, Pl. xxvii, Figs. 3, 3a, 3b; *Homalocranium planiceps* Dum., Bibl. Erp. Gen. vii, 1834, p. 857; Bocourt Miss. Sci. Mex., 1883, p. 581, Pl. xxxvi, Fig. 7; Jan, Icon. Gen. Ofid. i, 15 ii, Fig. 2.

Lower California.

**Tantilla nigriceps** Kennicott.

Proc. Acad. Phila., 1860, p. 3:8; Cope Check List Batr. Rept. N. Amer., 1875, p. 3:; *Scolecophis fumiceps* Cope, Proc. Acad. Phila., 1860, p. 371; *Homalocranium graculum* Boc. Miss. Sci. Mex. Rept., 1883, p. 582, Pl. xxxvi, Fig. 8 (abnormally with two preocular plates).

In a specimen of this species from southwestern Texas there is but one postocular on one side.

Texas generally, except the east.

**Tantilla coronata** Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 131; Cope, Jour. Phil. Acad., 1875, p. 144; *Homalocranium coronatum* Bocourt Mission Sci. Mexique Reptiles, 1883, p. 589, Pl. xxxvii, Fig. 3:; *Homalocranium wagnerii* Jan, Icon. Gen. Ofid. i, 14 ii, Fig. 3.

Gulf States to Florida inclusive.

In its distribution this species extends much farther east than any of its North American congeners. It is yet rare in museums. A specimen is in my collection from Volusia, Lake George, Florida.

**VIRGINIA** Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 127; Cope, Bull. U. S. Nat. Mus., 32, 1887, p. 53.

Head distinct from the body. Cephalic plates normal. Two nasals; posterior one not invaded by the nostril. Prefrontals and loreal entering into the orbit, and suppressing the anteorbitals. Superciliaries well developed. Genaeal scuta, 2 pairs. Pupil circular. Scales smooth. Postabdominal scutellum bifid. Subcaudal scuta all divided.

The distinction of the head from the neck and the relatively narrow frontal plate in this genus suggest affinities to the Coronellinae. The lateral head scuta are like those of *Rhabdosoma* and its immediate allies

But two species are known:

Scales wider, in 15 rows ..... *V. valeriae*.

Scales narrow, in 17 rows ..... *V. elegans*

The species occur in both the eastern and Austroriparian districts; the *V. elegans* in the western part of the latter only.

**Virginia valeriae** Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 127; Cope, Check List Batr. Rept. N. Amer., 1875, p. 35; Jan, Icon. Gen. Oph. i, 12 ii; Fig. 5; *Carpophis harperii* Dum., Bibr. Erp. Gen., 1854, vii, p. 135.

Not yet found north of the Carolinian division of the eastern district.

**Virginia elegans** Kenn.

Proc. Acad. Phila., 1859, p. 99; Cope, Check List Batr. Rept. N. Amer., 1875, p. 35; Jan, Icon. Gen. Oph. i, 12 ii; Fig. 6.

The specimens show considerable variation in the number of the postocular scuta. Thus in two specimens from Fort Towson, Arkansas, (2055), there are 3 on each side; in 12023, from Mount Carmel, Illinois, there are 2 on each side; and in 13632, from Helotes, Texas, the 2 are fused into a large one on each side.

The difference between this species and the *V. valeriae* are restricted to the form and number of the scales. Beyond these I have not been able to detect any.

**CONTIA** Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 110; Cope, Proc. Acad. Phila., 1860, p. 251; Bull. U. S. Nat. Mus., 1887, p. 53; *Sonora* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 117; *Eirenis* Jan, Elenco Sist. d. Ofidi, 1863, p. 48.

Dentition complete, and the teeth of maxillary bone of equal length. The scales are smooth and without pits, and the anal plate is divided. The head shields are normal; the nasal, usually entire in the genus, is sometimes divided by a suture from the nostril to the labial border. Two pairs of genaeals; a loreal; rostral obtuse. The head is little distinct from the body, and the pupil is round.

This genus is widely distributed over the warmer temperate regions of the Northern Hemisphere. Several species are described by Jan from Syria. The division of the nasal plate is never complete, although it is present below the nostril sometimes. I suspect that the Sonora of Baird and Girard is established on a species of this genus. They state that the nasal plates are distinct, but on examination of the typical specimen I find that this is not the case. The rostral plate is not more prominent than in the *C. episcopa*, and the division of the superciliary plate is probably abnormal.

The three North American species differ as follows :

Scales in 17 series; superior labials 8; body compressed behind; black above.

*C. pygæa*

Scales in 15 series; superior labials 7; body not compressed; rostral rather prominent; light, with or without black cross-bars ..... *C. episcopa*

Scales in 15 rows; superior labials 7; body not compressed; rostral not prominent; back brown, with pale borders; sides, lead colored; below cross-banded. *C. mitis*

The *C. pygæa* is Floridian; the *C. episcopa* from Texas and the Sonoran region, and the *C. mitis* is from California.

#### *Contia pygæa* Cope.

Proc. Acad. Phila., 1871, p. 222.

The belly is salmon red in life. Florida.

#### *Contia episcopa* Kennicott.

Cope, Check List N. Amer. Batr. Rept., 1875, p. 36; Bull. U. S. Nat. Mus. No. 20, 1880, p. 21. *Lamprosoma episcopum* Kenn., U. S. Mex. Bound. Surv., II, 1859, p. 22, Pl. VIII, Fig. 2. *Homalosoma episcopum* Jan, Icon. Gen. Ophid., I, 13, iv, Fig. 2.

Scales in fifteen rows, all smooth; superior labials, seven; the orbit bounded by the third and more largely by the fourth; loreal small, quadrangular, longer than high; oculars, 1-2; anterior short, covered above by superciliary; postoculars resting on fourth labial; fifth and sixth labials equal, as high as long; parietals large, long; frontal longer than wide; prefrontals transverse. Internasals partly separated by rostral, which is not very prominent. Inferior labials six, first pair meeting, fourth largest. Postgenaeals extremely short. Temporals little larger than body-scales, 1-2. Muzzle obtuse; head scarcely distinct; eye small. Gastrosteges 163; anal 1-1; urosteges varying in Texan specimens from 35 to 45.

There are three well-marked color varieties, which pass into each other. They are as follows:

Ground color ashen to rosy, with the scales broadly tipped with brown. A few only of the median rows of dorsal scales may be red, and the top of the head may or may not be brown. .... *C. e. episcopa*.

Ground color light yellow, tinged with brown above; three median dorsal rows orange. Top of head, from anterior border of frontal to near end of occipitals, black. A transverse black spot commencing on the fourth scale behind the occipitals, two scales long, and including the fourth row of scales from the gastrosteges on each side. .... *C. e. torquata*.

Back traversed by from nineteen to twenty-one black cross-bands of three and a half scales in length; there are six on the tail. Belly uniform. . . . *C. e. isozona*.

These subspecies pass into each other by distinct gradations, although the intermediate forms are less abundant than the types.

This is a characteristic species of western Texas. It is common west of Fort Worth to Fort Concho and about Helotes in the South. It exhibits a great range of color-variation, and, since it is evident that the *C. isozona* must be reckoned as one of its varieties, its range extends to Utah and Arizona.

***Contia episcopa episcopa* Kenn.**

Cope, Bull. U. S. Nat. Mus. No. 20, 1880, p. 21; Cope, Bull. U. S. Nat. Mus., No. 20, 1880, p. 21. *Lamprosoma episcopum* Kennicott, U. S. Mex. Bound. Surv., II, Reptiles, 1859, p. 22; Pl. VIII, Fig 2. *Homalosoma episcopum* Jan, Icon. Gen. Ophid., I, 13, iv, Fig. 2.

Texas.

***Contia episcopa torquata* Cope.**

Bull. U. S. Nat. Mus., No. 17, 1880, p. 21.

Northern Texas.

***Contia episcopa isozona* Cope.**

Bull. U. S. Nat. Mus., No. 20, 1880, p. 21. *Contia isozona* Cope., Proc. Acad. Phila., 1866, p. 304. Rept. U. S. G. G. Surv. W. of 100th Mer., v. p. 537, Pl. XVIII, Figs. 1-1a.

There are four specimens of this form in the collection; in two of them the ground color is ashy, in two red.

I suspect that the *Sonora semiannulata* of Baird and Girard was established on an abnormal specimen of this subspecies. That specimen is remarkable in having the superciliary plate divided symmetrically on each side by a suture, which cuts off a plate whose apex reaches the parietal and which Baird and Girard term a third postocular. The muzzle was somewhat wrinkled, so as to produce folds of the integument; this led to the mistaken belief that the nasal is divided. Omitting these two characters, there remains only a slightly more protuberant rostral plate, which is not more in my opinion than an individual peculiarity. The coloration is identical with that of the *C. e. isozona*. More specimens will be necessary to settle the question definitely. Should the identification here suggested prove necessary, the name of the species will stand as *Contia semiannulata*, with the subspecies *episcopa*, *torquata*, and *semiannulata*.

***Contia mitis* Bd. and Gird.**

Cat. Serp. N. Amer., 1853, p. 100; Check List Batra. Rept. N. Amer., 1875, p. 36. *Homalosoma mite*, Jan. Icon. Gen. Oph. I, 13, iv, Fig. 1.

California.

***LODIA* Bd. and Gird.**

Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 116.

Head distinct from the body. Two frontal plates, a small anterior one being situated between the post-frontals immediately in advance of the

frontal proper. One nasal. Loral entering into the orbit; above it one autoorbital. Superciliaries well developed. Genieals, one pair. Pupil circular. Scales smooth. Postabdominal scutella bifid. Subcaudals all in pairs.

*Lodia tenuis* Bd. and Gird.

Cat. Rept. N. Amer. Serpents, p. 116, 1853; Cope, Check List N. Amer., Batr. Rept., p. 36, 1875.

This species so much resembles the *Contia mitis* as to lead to the suspicion that its generic peculiarities are abnormalities of the head scuta. The relations of the loreal plate are, however, symmetrical, and the frontal plate is wider than in the *C. mitis*. The coloration is identical in alcohol. The head is relatively shorter. To this fact are to be ascribed its tegumental peculiarities. It is in any case a type of recent origin.

Puget Sound, Oregon.

#### CEMOPHORA Cope.

Proc. Acad. Phila., 1860, p. 244; Bull. U. S. Nat. Mus., 32, 1887, p. 50; Jan, Eleoco Sist. d. Ofidi, 1863, p. 45.

Head small, continuous with the body. Rostral plate large, prominent, subtriangular. One pair of prefemoral plates, and one of internasals. One nasal; nostril in the middle. One loral. Pre and post orbitals present. Superciliaries, eyes, and mouth small. Teeth longer posteriorly. Scales smooth. Postabdominal scutum entire; subcaudals bifid.

But one species of this genus is known. Its general characters are as follows:

Scales in nineteen rows; superior labials six, the eye over the third; tail about one-eighth of total length; red, crossed by pairs of black rings separated by a yellow one, which is divided by a black spot on the side. .... *C. coccinea*.

#### *Cemophora coccinea* Blumenbach.

Cope, Proc. Acad. Phila., 1860, p. 244.

*Coluber coccineus* Blumenbach, in Lich. and Voigts Magazine, v, 1788, Pl. v; Gmelin,

Syst. Nat., Ed. XIII, i, iii, 1788, 1877; Harlan, Jour. Acad. Phila., v, 1827, p. 356.

*Heterodon coccineus* Schleg. Ess. Physion. Serp., 1837, 102, Pl. iii, Figs. 15, 16.

*Rhinoestoma coccinea* Holbrook, N. Amer., Herpet., iii, 1842, 125; Bd. and Gird., Cat., 1853, 118.

*Simotes coccineus* Dum. Bibr., Exp. Gen. VII, 1854; Günther, Cat. Colubr. Snakes, Brit. Mus., 1858.

*Cemophora copei* Jan, Archiv. p. la Zoolog. Modena, II, 1863, p. 21.

The *Cemophora coccinea* is a species of the Austroriparian region, but it has not been found in the Texan district, nor does it ascend the Mississippi River as far as the region extends. It is especially abundant in Florida. The specimen from Tennessee described by Jan under the name *C. copei* presents the abnormality of the loreal reaching the orbit below the preocular.

**GYALOPHIUM** Cope.

Proc. Acad. Phila., 1860, 243; Bull. U. S. Nat. Mus., 1887, 32, p. 52.

Form stout, tail short. Head slightly distinct, large, depressed. Rostral plate acute, its anterior border elevated, its upper surface concave. It is produced backwards, separating the internasals and prefrontals. Internasals present; prefrontals, one pair. Nasal confounded with the first labial, a groove from the nostril to the suture of the second labial. No loreal, its place supplied by the prefrontal. One preocular. Postgenitals rudimental. Scales smooth; anal and subcaudal scutella divided. Teeth small, of equal lengths. Pupil round.

This genus introduces us to a type which is especially Mexican and which includes the genera *Ficimia* Gray, *Ogmios* Cope, and *Conopsis* Günther. *Sympholis* Cope is probably also allied, as well as perhaps *Geagras* Cope. They all have protuberant rostral shields, which are in the first three genera named more or less recurved. Besides the *G. canum* there is but one species of *Gyalopium*, the *G. pubium* Cope,\* which has been found in Yucatan.

Rostral plate reaching frontal; seventeen rows of scales; seven labials; quadrate brown dorsal spots; larger ..... *G. pubium*.

Rostral not reaching frontal; seventeen rows of scales; seven superior labials; transverse brown bands; smaller ..... *G. canum*.

**Gyalopium canum** Cope.

Proc. Acad. Phila., 1860, p. 241. Coates, U. S. G. G. Expl. Surv. W. 100th Mer., V, p. 624, Pl. xviii, f. 2, 2a; Cope, Check List N. Amer. Batr. Rept., 1875, p. 36. *Ficimia cana* Garman, Mem. Mus. Comp. Zool., Cambr., VIII, 1883 p. 161.

Arizona.

**ABASTOR** Gray.

Cat. Snakes Brit. Mus., 1849, p. 78; Bd. and Gird., Cat. Serp. N. Amer. 1853, p. 125; Cope, Bull. U. S. Nat. Mus. 32, 1887, p. 53.

Head subconical, continuous with the body. Cephalic plates normal. One nasal, grooved beneath the nostril. No anteorbitals. One loreal, together with the prefrontals, constituting the orbit anteriorly. Teeth equal. Pupil circular. Scales smooth. Last abdominal scutellum bifid. Subcaudals all bifid.

This genus is represented by a single species, which inhabits the southern part of the Neartic region. It is thus characterized:

Scales in nineteen rows; superior labials seven; tail one-seventh of total length, or shorter. Bluish black, with three red stripes above; below flesh-colored, with a series of bluish-black spots on each side ..... *A. erythrogrammus*.

**Abastor erythrogrammus** Dandín.

Gray, Cat. Snakes Brit. Mus., 1849, 78; Bd. and Gird., Cat. Snakes N. Amer., 1852, 125; Cope Check List Batr. Rept. N. Amer., 1875, 35.

*Coluber erythrogrammus*, Dand., Hist. Rept., VII, 1799, 93, Tab. 83, Fig. 2 Holbr., N. Amer. Herp., 1st ed., I, 1836, 115, Pl. xxii.

\* Proceeds. Acad. Phila., 1866, p. 126. *Ficimia ornata* Bocourt, Mission Scientif. de Mexique, p. 571, Pl. xxv, Fig. 10.



*Helicops erythrogammus* Wagl., Nat. Syst. Amph., 1830, 170; Holbr., N. Amer. Herp., 2d ed., III, 1842, 107, Pl. xxv.

*Homalopsis erythrogrammus* Boie, Isis, 1827, 551; *Calopisma erythrogrammus* Dum. and Bibr., Erp. Gen., VIII, 854; Jan, Icon. Gen. Ofid., II, 29, IV, Fig. 2.

*Hydrops erythrogrammus* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1843, p. 144.

Austroriparian region, eastern part, including Florida.

#### FARANCIA Gray.

Cat. Snakes Brit. Mus., 1848, p. 74; Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 123; Cope, Bull. U. S. Nat. Mus. 32, 1857, p. 52.

Head slightly distinct from the body. Internasal plate single. One nasal grooved beneath the nostril. No preorbital; prefrontal and loreal constituting the anterior portion of the orbit. Postorbitals present. Scales smooth. Postabdominal scutella bifid. Subcaudals in pairs.

This genus is known from the Louisianian district of the Austroriparian region. It does not occur in the Texan district and is rare in the Floridan. It is represented by only one species, which is defined as follows:

Dorsal scales in nineteen rows; superior labials seven; two postoculars; tail from one-fifth to one-seventh total length. Bluish black, with subquadrate red spots on the sides; belly red, with bluish-black spots..... *F. abacura*.

#### *Farancia abacura* Holbrook.

Bd. and Gird., Cat. N. Amer. Snakes 1853, p. 123; Cope Check List Batr. Rept. N. Amer. 1875, 35.

*Colubur abacurus* Holbr., N. Amer. Herp. I, 1836, 119, Pl. xxiii.

*Homalopsis Reinwardtii* Schl., Ess. Phys. Serp. Part. descrip., 1837, 357.

*Hydrops Reinwardtii* Gray, Zool. Misc. 1842, 67.

*Hydrops abacurus* Dum. & Bibr., Erp. Gen. Tab. 65.

*Helicops abacurus* Holbr., N. Amer. Herp. 2d ed. III, 1842, III, Pl. xxvi.

*Farancia Drummondii* Gray, Zool. Misc. 1842, 69.

*Farancia fasciata* Gray, Cat. of Snakes, Brit. Mus. 1849, 74.

*Calopisma abacurum* Dum. Bibr., Erp. Gen. VII, 1854.

*Hydrops abacurus* Garman, Mem. Mus. Comp. Zool. Cambr. VII 1843, p. 144.

*Calopisma Reinwardtii* Jan, Icon. Gen. Ofid. II, 29 VI, figs. 1, 2.

Dr. R. W. Shufeldt found this species abundant near New Orleans. He says that it is generally present in swampy ground, or on the shores of water, coiled beneath logs and other objects. It is of a gentle disposition, and grows to a considerable size, one specimen sent by him to the National Museum measuring nearly 6 feet in length. The species ranges north to southern Indiana.

Louisianan district of Austroriparian Region.

#### CHIONACTIS Cope.

Proc. Acad. Phila. 1861, p. 303; Check List N. Amer. Batr. Rept. 1875, p. 35; Bull. U. S. Nat. Mus., 1887, p. 53. *Lamprosoma* Hallowell, Proc. Acad. Phila. 1856, p. 310; Report Surv. U. S. Pac. R. R. x 1859, Williamson's Rept., p. 15; (preoccupied).

Teeth of equal length, posterior ones not channeled; head depressed, eyes small; a prominent rostral, two internasals and two prefrontals; one anterior ocular; a loreal. . Anal plate and subcaudal scuta divided; scales smooth.

I have referred this genus to the Calamarinæ, where it has some affinity to *Contia* and to *Conopsis*. It is a transitional form. Two species are known which differ as follows:

Yellow with black cross bands, or annuli.....*C. occipitalis*.  
Brown with darker narrow longitudinal stripes.....*C. diasii*.

The *C. diasii*\* Cope has been found in the state of Puebla, Mexico; the *C. occipitalis* is so far only known from the deserts of the lower Colorado River, Arizona.

***Chionactis occipitalis* Hallow.**

Cope, Proc. Acad. Phila. 1866; p. 310; Check List Batr. Rept. N. Am. 1875, 35.  
*Rhinostoma occipitale* Hallowell Proc. Acad. Phila 1854, 95; *Lamprosoma occipitale*  
Hallow, l. c. 1856, 310; Baird U. S. Mex. Bound. Survey, 1859, 21, Pl. xxi, fig. 1.

A variety of this species was described by Kennicott under the name of *C. o. annulatus* (op. cit.) based on two specimens from the Colorado Desert. They only differ from the type in the continuance of the black cross bands across the abdomen, forming complete rings. No. 2105; 15, 7: 172, 43: 350, 64 mm.

The light color of the specimens of this species in alcohol is yellow in life, with some pink intermixed, forming a handsome combination of colors.

**RHINOCHILUS Bd. and Gird.**

Cat. Rept. N. Amer. Serpents, p. 120; Cope, Check List N. Amer. Batr. Rept., 1875, p. 36; Proc. Amer. Phila. Soc., 1886, 487; Bulletin U. S. Nat. Mus., 1887, p. 52.

Head separated from the body by a moderately contracted neck. Rostral plate produced, but not recurved above. Internasal and prefrontal plates. Two nasals; nostrils between. On loreal. One anterior orbital. Scales smooth. Postabdominal scutella entire. Subcaudal scutella all undivided.

Two species of this genus are known, as follows:

Scales in twenty-three rows; labials eight; tail one-tenth total length. A dorsal series of numerous square black spots separated by red spaces, sides black-varied; belly white.....*R. lecontei*  
Scales in seventeen rows; labials eight; tail one-eighth total length; a few broad and long cross bands on body above, extending to the borders of the belly.

*R. antonii*.†

\* Proc. U. S. Nat. Mus. 1886, p. 188. *Toluca lineata* Kenn. hinc *Conopsis lineatus* Bo-  
court Mission Sci. de Mexique Reptiles, p. 565, Pl. xxv, fig. 4; not *Toluca lineata* Kenn.

† Dugés, Proc. Amer. Philos. Soc., 1886, p. 290; fom Mazatlan, Mexico.

*Rhinochilus lecontei* Bd. and Gird.

Cat. N. Amer. Serp., 1853, 120; Baird U. S. Mex. Bound. Surv., II, Rept., p. 21, Pl. xx; Cope, Check List Batr. Rept. N. Amer., 1875, 36, Jan. Icon. Gen. Ofid. III, 48 III, Fig. 1.

This species displays remarkable variations in coloration. In No. 5168 the large blotches are perfectly distinct, and their lateral interspaces have but faint traces of markings. In 2020, 2023, 2030, 2031, 11743, and 11784, all of small size, and some fully grown, there is a vertical black spot between the dorsal blotches on each side. In 8376, 4471, and 4472 the entire space on the sides between the dorsal blotches is marked with a black spot on the center of each scale. Nos. 8021 and 8022 are more like the first noted variety, but carry the peculiarity further. The dorsal blotches are perfectly distinct from each other, and are truncate, and not narrowed at their inferior border. Very few of the scales have light centers, and there are no intermediate lateral spots. Belly spots sparse. In No. 8022 a wide longitudinal median black band forms with the occipital spot an anchor-shaped figure. This variety is approached nearly by the second and only other species of the genus, the *R. antonii* Dugés, which has the black cross bands fewer in number and wider. It is from Mazatlan. Individuals also differ in the relative size of the loreal plate and number of cross bars. In one from the Canadian River there are thirty-seven rings, in one from the Llano Estacado, twenty-six. In another from the same locality the abdomen is black tessellated; in all others, white.

The range of the *Rhinochilus lecontei* is throughout the Sonoran district. The most eastern and northern locality known for it is Garden City, in southwest Kansas where Prof. Cragin, of Topeka, obtained a specimen. It presents the anomaly of having the loreal plate to enter the orbit below the preocular.

*OSCEOLA* Bd. and Gird.

Cat. Rept. N. Amer. Pl. I, Serpents, 1853, p. 133.

Head distinct from the body. Cephalic plates normal. Prefrontals extending to the upper labials, and suppressing the loreal. Two nasals, with nostril between. One anterior orbital. Mental scutella two pairs. Body slender, subcylindrical. Scales smooth. Postabdominal scutellum entire. Subcaudals bifid.

*Osceola elapsoides* Holbrook.

Bd. and Gird., Cat. Serpt N. Amer., 1853, p. 133; Cope, Check List, 1875; p. 36, *Calamaria elapsoides* Holbrook, N. Amer. Herpet., 1842, III, 119, Pl. 28. *Ophibolus doliiatus* var. *elapsoides* Garman, Mem. Mus. Comp., Zoöl. Cambr., VIII, 1843, p. 155.

In two specimens of the eight which have come under my observation, the loreal plate is present (Nos. 9689 and 11988). In No. 5560 there are two temporal scuta on one side, instead of the normal number, one. The Floridan district.

## OPHIBOLUS Bd. and Gird.

Cat. Rept. N. Amer. Pt. I, Serpents, 1853, p. 82. Cope, Check List North American Batr. Reptilia, 36, 1875; Proc. Amer. Philos. Soc., 1886, 487; Bull. U. S. Nat. Mus. 1887, p. 78. *Lampropeltis* Fitzinger *nomen nudum*, Systema Reptilium, 1843, p. 25; Cope, Proc. Acad. Phila., 1860, p. 254. *Sphenophis* Fitz., *loc. cit. nomen nudum*. *Bellophis* Sockington, Proc. California Acad. Sci., 1877, p. 52.

Posterior maxillary teeth larger and stronger than the anterior. Head but little distinct. Cephalic scuta normal. Rostral plate not modified; loreal present; one preocular. Scales smooth, with two apical pits. Anal scutum entire; subcaudal scuta in two rows. Pupil round.

This genus represents in North America the *Cororella* of the Old World, but is abundantly distinct in its entire anal scutum and its double scale pits. Its six species form a very homogeneous group, and although they present abundant differences to the eye, critical examination shows that their characters are by no means easy to determine. Some of them (*O. doliiatus* and *O. getulus*) offer a degree of variation within themselves which is not equaled by any other North American species, with the exception of the *Eutaenia sirtalis*. They afford excellent lessons in the evolution of specific types.

The characters of the species are as follows:

## I. Temporal scuta 2 (1) 2 (3) 3.

Scales in twenty-one rows; large brown or red dorsal spots or saddles broadly black bordered, forming pairs of black cross bands above..... *O. doliiatus*.

## II. Temporal scuta 2 - 3 - 4.

$\alpha$  Scales in 21 - 3 rows.

Eight superior labials; numerous brown dorsal saddle spots closed at the sides, ..... *O. multistratus*.

Seven superior labials; smaller, head wide, distinct, body slender; numerous black rings more or less split with red..... *O. pyrrhomelas*.

Seven labials; large, robust, head little distinct; black with or without white transverse or longitudinal bands..... *O. getulus*.

Seven labials; robust, head not distinct; light brown, with small transverse, reddish dorsal spots faintly dark bordered..... *O. rhombomaculatus*.

$\alpha\alpha$  Scales in twenty-five rows.

Seven labials; robust; light brown with a median dorsal, and two lateral rows of darker brown spots faintly dark bordered..... *O. calligaster*.

The distribution of these species is as follows: The *O. doliiatus* covers North America east of the Rocky Mountains and south of latitude 50°, and south to Panama. The *O. getulus* has nearly the same eastern range, not reaching so far north by 10°, and covers the Sonoran and Pacific regions besides, but is scarcely found in continental Mexico. The *O. pyrrhomelas* inhabits the Sonoran and southern part of the Pacific regions. The *O. rhombomaculatus* occupies the middle regions east of the Appalachian Mountains, and the *O. calligaster* the corresponding region west of those mountains, and extends west as far as the Pecos River of Texas.

*Ophibolus doliatus* Linn.

- Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 89; Cope, Check List Batr. Rept. N. Amer., 1875, pp. 4 and 36; Proc. U. S. Nat. Mus., 1888, p. 381.  
*Coluber doliatus* Linn., Syst. Nat., i, 1766, 379; Gmel. Linn. Syst. Nat. Ed., xiii, i, iii, 1788, 1096; Harlan, Journ. Ac. Nat. Sci. Phila., v, 1827, 362.  
*Coronella doliata* Holbrook, N. Amer. Herp., iii, 1842, p. 105, Pl. 24; Dum. and Bibl. Erpet. Gen., vii, p. 621; Günther, Cat. Colubr. Snakes Brit. Mus., 1858, p. 41.  
*Coronella coccinea* Schlegel, Essai s. le. Phys. Serp., i, 1837, p. 130; ii, p. 57.

Scales in twenty-one rows, rather wide. Tail rather short, entering total length six and two-thirds times. Head rather flat, little distinct. Loreal small, longer than high; one preocular, two postoculars. Temporals 2-2 (rarely 1-2). Frontal rather wide, narrowing the superciliaries in front. Parietals rather wide, the length a little less than that of frontal and prefrontals combined. Seven superior labials all higher than long, except the first, the third and fourth bounding the orbit. Geniials, the anterior about twice the size of the posterior. Size medium to small.

The ground color of the superior surfaces varies from ashen to bright yellow, but it only appears as transverse spaces between the broad reddish brown to crimson spots or saddles which cross the back. The extent to which these spots preserve their outlines or surround the body like rings, indicate the characters of various subspecies. The coloration of the head varies from red or black, abruptly cut off posteriorly, to banded with two chevrons, a brown within a yellow one, with a yellow cross band on the nose.

The variations of this species are remarkable, and form the subject of some remarks which I have made on former occasions.\*

I. No yellow band posteriorly from orbit (a yellow half collar).

α Dorsal spots or saddles (red) open at the side, their adjacent borders forming pairs of black rings.

Interspaces between red saddles, open below; scales not black-tipped; front more or less black; first black ring on nape only..... *O. d. coccinea*.

Interspaces between red saddles closed by black spot below; scales black tipped; front black; first black ring complete..... *O. d. polyzona*.

Interspaces not closed; rings including first complete on belly; first yellow band crossing occipital plates; front black; scales not black tipped. *O. d. conjunctus*.

α α. Dorsal saddle spots closed at the sides

β. Saddles closed by a single black tract on the middle of the belly; no spots between saddles.

Dorsal spots undivided medially; front black; first black ring complete;..... *O. d. annulatus*.

Dorsal spots divided longitudinally by a median black connection; front black..... *O. d. gentilis*.

β β. Inferior borders of saddles separate and not confluent with each other below.

Saddles completed on gastrosteges; no alternating spots; no black collar;..... *O. d. parallelus*.

Saddles completed on gastrosteges; spots opposite intervals forming a single series on the middle line of the belly..... *O. d. aspidotus*.

Saddles completed above the gastrosteges; alternating spots which do not meet on the middle line of the belly..... *O. d. doliatus*.

\* Bull. U. S. Nat. Mus., i, 1875, p. 4; Proc. U. S. Nat. Mus., 1888, p. 381.

II. A yellow band from orbit bounded below by a black or brown one. (Saddle spots closed laterally above gastrosteges; superciliary light spots or bands).

A half collar nearly or quite touching occipital plates, no bands; alternate spots largely on gastrosteges ..... *O. d. collaris*.

Neck with longitudinal bands; alternate spots largely on gastrosteges. *O. d. clericus*.

Neck with bands; alternate spots entirely on scales. .... *O. d. triangulus*.

The *O. d. polyzona* Cope (*Coronella formosa* Schl.) and *O. d. conjuncta* Jan. (*O. d. occipitalis* Cope) are exclusively Mexican and Central American.

***Ophibolus doliatus coccineus* Schleg.**

Cope, Check List N. Amer. Batr. Rept., 1875, p. 36; Proc. U. S. Nat. Mus., 1888, p. 382.

*Coronella coccinea* Schlegel, Ess. Phys. Serp., II, 1837, p. 67, Pl. 2, Fig. 11.

*Lampropeltis coccineus* Cope, Proc. Acad. Phila., 1860, p.

*Ophibolus doliatus* Bd. and Gird., Cat. N. Amer. Serp., 1853, p. 89.

*Coronella doliata* var *gentilis* Bocourt, Mis. Sci. Mex. 1886, p. 610, Pl. xxxix, Fig. 5.

The Austroriparian region.

***Ophibolus doliatus annulatus* Kenn.**

Cope, Check List, Batr. Rept. N. Amer., 1875, p. 36; Proc. U. S. Nat. Mus., 1888, p. 382.

*Lampropeltis annulata* Kennicott, Proc. Acad. Phila., 1860, p. 329.

S. W. Texas and Nuevo Leon, Mexico.

***Ophibolus doliatus gentilis* Bd. and Gird.**

Cope, Check List Batr. Rept. N. Amer., 1875, p. 36; Proc. U. S. Nat. Mus., 1888, 383.

*Ophibolus gentilis* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 90; Marcy's Report Expl.

Red River, 1853, p. 229, Pl. VIII.

Arkansas.

***Ophibolus doliatus parallelus* Cope.**

Proc. U. S. Nat. Mus. 1888, p. 385. *Coronella coccinea* Jan, Icon. Gen. Ofid., I, 17, I, Fig. 1.

Floridan district.

***Ophibolus doliatus syspilus* Cope.**

Proc. U. S. Nat. Mus., 1888, p. 384. *Coronella doliata* var. *gentilis*, Jan, Icon. Gen. Ofid., I, 17, I, Fig. 2.

The Austroriparian region.

***Ophibolus doliatus doliatus* Linn.**

Cope Batr. Rept. N. Am. Check List, 1875, p. 37; Proc. U. S. Nat. Mus. 1888, p. 383.

*Coluber doliatus* Linn., loc. sup. cit.; Harlan, *Coronella doliata* Holbrook, loc. sup. cit.; Dum. Bibr. Erp. Gen., loc. sup. cit.; Günther, loc. sup. cit.

Austroriparian region and Carolinian district.

***Ophibolus doliatus collaris* Cope.**

Proc. U. S. Nat. Mus., 1888, p. 383.

*Coronella doliata* Jan, Icon. Gen. Ofid., I, livr. 14, Pl. IV, Fig. A. *Coronella doliata typica* L. Bocourt Miss. Sci. Mex. 1886, Pl. xxxix, Fig. 2. *Coronella eximia* Jan, loc. cit., I, 17, I, Fig. 3.

The Carolinian district.

***Ophibolus doliatus clericus* Bd. and Gird.**

*Ophibolus clericus* Bd. and Gird., Cat. Rept. N. Amer. Serpents, p. 88. Cope, Proc. U. S. Nat. Mus., 1888, p. 383.

Carolinian district, Louisianian district.

***Ophibolus doliatus triangulus* Boie.**

Cope, Check List N. Am. Batr., Rept., 1875, p. 37; Proc. U. S. Nat. Mus., 1888, p. 383.  
*Coluber triangulum* Boie, Isis von Oken. 1827, p. 537.

*Ablates triangulum* Dum. and Bibr., Erp. Gen., VII, 1854, p. 315; Hallowell, Proc. Acad. Phila., 1856, p. 245.

*Lampropeltis triangula* Cope, Proc. Phila. Acad., 1860, p. 256.

*Pseudoeclaps* Y Berthold, Abh. k. Gess. Wiss., Göttingen, I, 1843, p. 67, Pl. 1, Figs. 11-12.

*Coluber eximius* Dekay, N. York Fauna, Rept. 1842, p. 38; Harlan, Journ. Acad. Nat. Sci. Phila., 1827 p. 340; Holbrook, N. Am. Herp., III, 1842, Pl. 15; Günther, Catal. Colubr. Snakes Brit. Mus., 1858, p. 91.

*Ophibolus eximius* Bd. and Gird., Cat., 1853, p. 87.

***Ophibolus rhombomaculatus* Holbr.**

Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 86; Cope Check List Batr. Rept. N. Amer., 1875, p. 37.

*Coronella rhombomaculata* Holbr., N. Amer. Herp., III, 1842, p. 103, Pl. XXIII.

*Lampropeltis rhombomaculata* Cope, Proc. Acad. Phila., 1860, p. 255. *Ophibolus triangulus* var. *rhombomaculatus* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 156.

Carolinian district east of Allegheny Mountains.

***Ophibolus calligaster* Say.**

Cope, Check List N. Amer. Batr. Rept., 1875, p. 37.

*Coluber calligaster* Say, Harlan Med. and Phys. Researches, 1835, p. 122.

*Alabes triangulum* var. *calligaster* Hallow., Proc. Acad., Phila., 1856, p. 244.

*Lampropeltis calligaster* Cope, Proc. Phila. Acad., 1860, p. 255.

*Ophibolus evansi* Kennicott, Proc. Phila. Acad., 1859 p. 99.

*Ophibolus triangulus* var. *calligaster* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 155.

Illinois and Kansas to Texas.

***Ophibolus pyrrhomelas* Cope.**

*Ophibolus pyremelanus* Cope, Proc. Acad. Phila., 1866, p. 305; Check List Batr. Rept. N. Amer., 1875, p. 37 (*pyrrhomelas*), Rept. U. S. G. Surv., W. of 100th Mer., v, 1875, p. 537, Pl. XIX.

*Bellophis zonatus* Sockington, Proc. Cal. Acad. Sci., 1877, p. 52.

*Ophibolus getulus* var. *pyrrhomelas* Garman Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 157.

*Coronella multifasciata* Bocourt, Miss. Sci. Mex., 1886, p. 616; Pl. XL, fig. 2.

This species occupies a position between the *Ophibolus doliatus*, and the *Ophibolus getulus boylii*. It is in fact an *Ophibolus getulus boylii* of slender form and reduced size, in which the black spaces between the white rings are more or less split by red. This division, when complete, gives the snake the appearance of the *Ophibolus doliatus conjunctus*, and to a somewhat less degree of the *O. d. coccineus*. Such are specimens 8174, 4292, and 10200. Where the black is complete just at the middle

line of the back, we have a form like *O. d. genitilis*, as No. 8435. In 7845, 11753, and 13571 the red only appears on the anterior part of the body, and divides completely only a limited number of black rings behind the head. These approach nearest the *O. g. boylii*. The species further varies in the extent to which the black of the front covers the muzzle. The latter is white to the posterior part of the prefrontal scuta in 7845, 8174, and 10200; it is speckled at the end and on the sides in 8435 and 4292, and it is totally black in 11753 and 13571. The yellow half-collar crosses the posterior parts of the parietal plates in this species, advancing further forwards than in any of the subspecies of *Ophibolus doliatus* excepting the *O. d. conjunctus*.

The increased number of scales on the body and on the temporal region indicate that the affinities of this species are stronger with the *O. g. boylii* than with the *O. doliatus*. It inhabits a hotter and a drier region than the *O. boylii*, and as the conditions of the country are of later geologic origin than are those of California, the habitat of the *O. boylii*, we may conclude that it is a descendant of the latter. It appears in the southern part of California. It illustrates how, under a semitropical sun, a brilliant color makes its appearance little by little, and probably in a way totally different from that in which it appeared in the case of the *O. doliatus* (see that species).

*Ophibolus multistratus* Kenn.

Cope, Check List Batr. Rept. N. Amer., 1875, p. 37.

*Lampropeltis multistrata* Kennicott, Proc. Acad. Phila., 1860, p. 328; *Ophibolus triangulus* var. *multistratus* Garman Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 155.

Central region from latitude 40° to Mexican Plateau.

*Ophibolus getulus* Linn.

Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 85; Cope, Check List Batr. Rept. N. Amer., 1875, p. 37.

*Coluber getulus* Linn. Syst. Nat. I, 1766, p. 382; Gmel. Linn. Syst. Nat. XIII, III, 1788, p. 1106; Harlan, Journ. Acad. Phila., V, 1827, 358; Peale contr. Maclur. Lyc., I, 1829, Pl. v., Günther, Cat. Colubr. Snakes Brit. Mus., 1858, p. 249.

*Pseudoeclaps getulus* Fitz., New Class, Rept., 1826, p. 56.

*Herpetodryas getulus* Schleg., Ess. S. l. Phys. Serp., II, 1837, p. 198.

*Coronell i getula* Holbr., N. Amer. Herp., III, 1842, p. 95, Pl. 21; Dunn. and Bibr. Erp. Gen. VII, 617.

*Lampropeltis getula* Cope, Proc. Acad. Phila., 1860, p. 255.

Head little distinct, conical, not depressed, the muzzle slightly compressed and the rostral plate projecting beyond the lower jaw. Rostral plate moderately recurved on the superior face of the muzzle. Frontal rather wide, produced posteriorly. Loreal small; oculars 1-2. The eye not large, resting on the third and fourth superior labials. Temporal scales, 2-3-4. Superior labials seven, higher than long, except the first, sixth, and seventh. Inferior labials ten, fifth longest, post-geneials shorter than pre-geneials. Scales in from twenty-one to twenty-five rows, rather short, the sizes graduating insensibly. Tail short.



Ground color black, marked above and below with yellow or white spots and bands, the latter generally transverse, rarely longitudinal. Labial plates light-colored, with dark borders. Top of head black, with larger or smaller white or yellow spots.

This species ranges the entire nearctic realm as far north as about latitude 41°. It is not found in the neotropical realm, unless the Lower Californian district be embraced in it.

The variability of this species is in some respects considerable, while in others it is quite constant. A number of distinct species have been proposed on its forms, most of which I felt compelled to reduce to this one as subspecies at the time of writing my check list in 1875. Further reduction is made now. The number of rows of scales is not constant. In the subspecies *O. g. getulus*, they may be twenty-one or twenty-three; and in the *O. g. boylii* they may number twenty-three or twenty-five. The characters based on color indicate natural geographical subspecies, but the transitions from one to the other are not lacking. The subspecies are defined as follows:

1. Scales in 21 (3) rows.

Scales with yellow centers, sometimes collected into cross bands on the back; head yellow spotted above ..... *O. g. sayi*.

Narrow white dorsal cross bands bifurcating on the flanks to embrace alternating black areas; head, white spotted above ..... *O. g. getulus*.

Uniform black above; below, with white spots; head spots few ..... *O. g. niger*.

2. Scales in 23 (5) rows.

Scales of the sides with yellow or white centers; median dorsal region black, with cross-bands of scales with yellow centers; top of head, except muzzle, black ..... *O. g. splendidus*.

Black, with complete white annuli, which are wider on the sides than on the back; top of head black; of muzzle, white ..... *O. g. boylii*.

Black, with more or less numerous longitudinal stripes above and on the sides, parts of annuli present or absent; top of head, black; top of muzzle, white ..... *O. g. californica*.

The geographical distribution of these subspecies is well defined. Thus the *O. g. sayi* belongs to the Austroriparian region west of the Allegheny Mountains, and of the central region north to latitude 42°. The *O. g. getulus* occupies the Austroriparian and Eastern regions north to about latitude 42°. The *O. g. splendidus* is the type of the Sonoran district, and the *O. g. boylii* of the Pacific. The *O. g. californica* probably comes from the Lower Californian, but our specimens come from the southern part of the Pacific region.

This is the largest species of the genus, and is beautiful in all its forms. It is thoroughly harmless to mankind, and can be handled to any extent without showing fear or anger.

*Ophibolus getulus sayi* Holbrook.

Cope, Check List Batr. Rept. N. Amer., 1875, p. 37.

*Coronella sayi* Holbr., N. Amer. Herpet., III, 1842, p. 99, Pl. xxii; Dum. Bibr. Erp.

Gen. VII, 1854, p. 619; Günther, Cat. Colubr. Snakes Brit. Mus., 1858, p. 41.

*Coluber sayi* Dekay, N. Y. Fauna Rept., 1842, p. 41.

*Ophibolus sayi* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 84.

*Lampropeltis sayi* Cope, Proc. Phila. Acad., 1860, p. 254.

*Herpetodyas getulus* Schleg., Essai Phys. Serp., II, 1837, p. 198.

*Coronella getulus sayi* Jan, Icon., Gen. Ofid., I, 14 v, Fig. 2.

#### Austroriparian region.

##### *Ophibolus getulus getulus* Linn.

Cope, Check List Batr. Rept. N. Amer., 1875 p. 37.

*Coluber getulus* Linn., loc. sup cit.; Harlan, loc. sup. cit.; Peale, loc. sup. cit.; Günther, loc. sup. cit.

*Pendolaps getulus* Fitz., loc. sup. cit.

*Coronella getula* Holbrook, loc. sup. cit.; Dum. Bibr. Erpet. Gen., loc. sup. cit.; Jan. Icon. Gen., Ophid., I 14, v, Fig. 1.

*Anguis annulatus* Catesby, Nat. Hist. Carolina, II, 1743, p. 52, Pl. iii.

*Lampropeltis getula* Cope, loc. sup. cit.

In his pamphlet on the serpents of New York (Albany 1854) Prof. Baird remarks that this species is maritime in its northern distribution, being rarely found in the Northern States, excepting near the coast. It is occasionally seen in Long Island (New York), according to Dekay, and more frequently in eastern New Jersey. It is not cited by J. A. Allen in his catalogue of the reptiles and batrachians found in the vicinity of Springfield, Massachusetts (Proc. Boston Soc. Nat. Hist., XII, 1863, Dec.), nor is it included in the list of species found in the State which is included in the paper. In its western distribution it is not known from west of the Mississippi.

This form is said to be an enemy and a devourer of other snakes, especially of the venomous Crotalidæ. I have not personally met with a case of it. It is entirely inoffensive to man, making no hostile demonstrations. My daughter, when a girl of six or eight years, had several individuals as pets. They drank milk readily from a cup which she held in her hand.

##### *Ophibolus getulus niger* Yarrow.

Proc. U. S. Nat. Mus., 1882, p. 438.

#### Southern Indiana.

##### *Ophibolus getulus splendidus* Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 83; Cope, Check List Batr. Rept. N. Amer., 1875, p. 37; Baird, U. S. Mex. Bound. Survey, II, 1859, 20, Pl. xiv, Jan. Icon. Gen. Ophid., I, 12 vi, Fig. 1; *Lampropeltis splendida* Cope, Proc. Phila. Acad., 1860, 255.

#### Boundary region of United States and Mexico.

##### *Ophibolus getulus boylii* Bd. and Gird.

Cope, Check List Batr. Rept. N. Amer., 1875, p. 37.

*Ophibolus boylii* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 82; *Coronella balteata* Hallowell, U. S. Pacific R. R. Rept., x. Williamson's Rept., p. 14, Pl. v; Proc. Acad. Phila., 1853, p. 236.

*Lampropeltis boylii* Cope, Proc. Acad. Phila., 1860, p. 255.

*Coronella getulus*, var. *pseudogetulus* Jan, Icon. Gen. Ofid. I, Livr., 12 Pl., vi, Fig. 2.

*Ophibolus getulus californiæ* De Bl.

*Ophibolus californiæ* Cope, Check List Batr. Rept. N. Amer., 1875, p. 37.

*Coluber (Ophis) californiæ* De Blainville, Arch. Mus. d'Hist. Nat., Paris, III, 1834, p. 60, Pl. xxvii, Figs. 1, 1a, 1b; Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 153.

*Coronella californiæ* Dum. and Bibr., Erp. Gen., VII, 1854, p. 623.

*Ophibolus getulus eisenii* Yarrow, Proc. U. S. Nat. Mus., 1882, p. 439.

*Coronella getulus californica*, Jan. Icon. Gen. Ofid., I, Livr., 14 Pl. v., Fig. 3.

Southern California and Lower California.

**DIADOPHIS** Bd. and Gird.

Cat. Rept. N. Amer., Pt. I, Serpents, 1853, p. 112; Cope, Bull. U. S. Nat. Mus. 32, 1887, pp. 54.8<sup>o</sup>.

Head normal, distinct from body. Teeth of maxillary bone subequal, and in an uninterrupted series. Palatine teeth present. Cephalic plates normal; rostral normal, two nasals, one loreal. Scales smooth, unifossate. Anal plate and subcaudal scuta divided.

Diadophis is allied to Dromicus, but in that genus the last superior maxillary tooth is longer, and follows a toothless space, and the scales are pitless. Rhadinæa agrees with Diadophis in dentition, but has no scale pits, as in Dromicus. Both of these genera are Neotropical in distribution. The species of Diadophis are North American in distribution, except one from the Bahama Islands. It is, however, not unlikely that other species will be referred to this genus when the characters of their scale pits shall be known.

The North American species of Diadophis are difficult to define, owing to their variability. If exceptions to definitions were to be chiefly considered all might be regarded as one species. They are easily seen to be of common origin at no very remote period. The number of labial scuta is variable in all of the forms; the number of rows of scales is much less so. The width of the yellow neck collar is very variable; in the *D. regalis* it may be present or absent. The distribution of the spots on the belly, whether regular or irregular, coincides with other characters quite closely, but the absence of the median series from the form with 3 rows is of no significance. The light or dark color of the dorsal region characterizes geographical varieties of each of the three North American species. The species are characterized as follows:

- I. Tail long; urosteges 119; temporals 1-2.  
Scales in seventeen rows; superior labials, eight; light reddish brown above, white below; unspotted ..... *D. rubescens*.
- II. Tail short; urosteges not more than 60; temporals 1-1; generally a collar.  
Scales in seventeen rows; superior labials, seven; labials, throat, and belly irregularly spotted ..... *D. regalis*.  
Scales in fifteen rows; superior labials, seven; labials, throat, and belly irregularly spotted ..... *D. amabilis*.  
Scales in fifteen rows; superior labials, eight; labials, throat, and belly unspotted, or the belly with a median series of spots ..... *D. punctatus*.

The *Diadophis rubescens* Cope\* inhabits the Bahaman Island of New Providence. The *D. punctatus* is restricted to the eastern region of Nearctica; the *D. amabilis* belongs to the Central, the Pacific, and the Sonoran, while the *D. regalis* is Sonoran, extending its range as far south in Mexico as the Tierra Templada of Vera Cruz.

*Diadophis regalis* Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 115; U. S. and Mex. Bound. Surv., II, 1859, p. 22, Pl. xix, Fig. 2; Cope, Check List, 1875, p. 38.

Body above, uniform greenish ash to blackish brown; beneath, light yellow, scattered all over with small black spots. Dorsal scales in seventeen rows. Superior labials, seven; temporals, 1-1-1; oculars, 2-2.

Head proportionately short and broad behind; head flattened above; snout rounded. Eyes very small. Frontal plate subpentagonal, tapering posteriorly. Superciliaries narrower anteriorly. Body long and subcylindrical. Scales proportionally large and elongated, in seventeen rows; those of the outer row conspicuously broader. The upper and lower jaws and inferior surface of head spotted with black, on a light ground. The black spots of the inferior surface extend considerably beyond the anus.

Two distinct color forms are represented in this species, as follows:

Upper surfaces, bluish ashen; color of abdomen extending on first row of scales;  
..... *D. r. regalis*.  
Upper surfaces to gastrosteges brownish black; ..... *D. r. arnyi*

Of fourteen specimens of the *Diadophis regalis* examined, all have seven superior labials but two, which have eight.

*Diadophis regalis regalis* Bd. and Gird.

Loc. cit. Copel. c. *Diadophis punctatus regalis* Cope, Bull. U. S. Nat. Mus. 32, 1887, p. 80.  
Sonoran region.

*Diadophis regalis arnyi* Kennicott.

*Diadophis arnyi* Kennicott, Proc. Acad. Phila., 1859, p. 99; Cope, Check List, 1875, p. 38; *Diadophis punctatus arnyi* Cope, Bull. U. S. Nat. Mus. 32, 1887, p. 80; Jan, Icon. Gen. Ofid., I, 15, VI, Fig. 5.

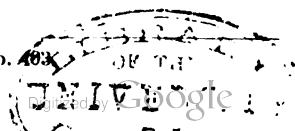
Central region; Mexican plateau to Guanajuato and Zacualtipan, Vera Cruz.

*Diadophis amabilis* Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 113; *D. docilis* Bd. and Gird., l. c. 114; *D. pulchellus* Bd. and Gird., l. c. p. 115; *D. punctatus* var. *stictogenys* Cope, Proc. Acad. Phila., 1860, p. 250; *D. texensis* Kennicott, l. c., 1860, p. 328.

Body above, bluish slate color to deep blackish brown; beneath, yellowish white with crowded small black spots. Occipital ring narrow. Dorsal scales in fifteen rows; labial plates, seven above; oculars, 2-2; temporals, 2-2-2.

\* Proc. Amer. Philos. Soc., 1835, p. 463.



Head, body, and tail slender; head flattened above; body subcylindrical; tail subconical and tapering into a point. Frontal plate subpentagonal, less tapering posteriorly than in *D. punctatus*, and subacute. Occipitals narrow and elongated. Prefrontals as in *D. punctatus*. Superciliaries narrower and nearly of the same width throughout their length. Upper labials seven, sixth largest. Lower labials eight, fifth largest. Scales rather short, subelliptical, considerably larger on the sides than on the back, especially the outer row. Numerous small spots are scattered all over the lower part of the body, from the head to near the end of the tail. The upper surface and sides of head are blackish brown. The ground color of the abdomen is orange in life.

This species exhibits the same range of color variation as in *D. regalis*, with some exceptions. Thus there is a light-bluish form and a blackish form, the former western, and latter more eastern. I have seen no specimen without a nuchal collar. The specimens are always smaller and more slender than the fully grown *D. regalis arnyi*. These forms are distinguished as follows:

Color above bluish, below orange, the latter color covering two rows of scales.	<i>D. a. pulchellus</i> .
Color above bluish to the gastrosteges.....	<i>D. a. docilis</i> .
Color above blackish brown to the gastrosteges; labials brown; ventral spots irregular.....	<i>D. a. amabilis</i> .
Color above blackish to gastrosteges; labials yellow; ventral spots in three series.	<i>D. a. stictogenys</i> .

The *D. a. pulchellus* and *D. a. amabilis* are Californian; the *D. a. docilis* is known from Texas and Sonora; while the *D. a. stictogenys* ranges from Texas to Louisiana and Georgia.

***Diadophis amabilis pulchellus* Bd. and Gird.**

*Diadophis pulchellus* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 115.

*Diadophis punctatus pulchellus* Cope, Proc. Acad. Phila., 1883, p. 27; Jan, Icon. Gen. Ofid., 1, 15, vi, Fig. 3.

Oregon and California.

***Diadophis amabilis docilis* Bd. and Gird.**

*Diadophis docilis* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 114.

*Diadophis texensis* Kennicott, Proc. Acad. Phila., 1860, p. 328; *Diadophis punctatus docilis*, Jan, Icon. Gen. Ofid., 1, 15, vi, Fig. 2.

Texas and Sonora.

***Diadophis amabilis amabilis* Bd. and Gird.**

*Diadophis amabilis* Bd. and Gird. Cat. 1853, p. 113; *Diadophis punctatus amabilis*, Jan, Icon. Gen., Ofid., 1, 15, vi., Fig. 4.

Southern California.

***Diadophis amabilis stictogenys* Cope.**

*Diadophis punctatus* var. *stictogenys* Cope, Proc. Acad. Phila., 1860, p. 250. *D. punctatus stictogenys* Cope, Check List, 1875, p. 37.

Louisiana to Georgia.

*Diadophis punctatus* Linn.

Bd. and Gird., Cat. 1853, p. 112, No. 1. Cope, Check List Batr. and Rept., 1875, p. 37.  
*Coluber punctatus* Linné, Systema naturæ, t. I, p. 376; Latreille, Hist. nat. des rept., t. IV, part 2, p. 136; Gmelin, Lin. Syst. Nat., t. I, part 3, p. 1089; Daudin, Hist. nat. des rept., t. VII, p. 178, Lacep., II, p. 287; Bonnat. Ophiol., p. 10; Merr. Tent., p. 136; Harlan, Journ. Acad. Nat. Sci. Phila., 1827, p. 354; and Med. Phys. Res., 1835, p. 117; Storer, Reports, 1839 p. 225; Holbr., N. Amer. Herpet., 1842, III, t. 18.  
*Natrix punctatus* Merrem, Tentamen, p. 136, spec. 193.  
*Homalosoma punctatum* Wagler, Syst. der Amph., 1830, p. 191.  
*Spilotes punctatus* Swainson, Cycloped. Rept., 1839, p. 364.  
*Calamaria punctata* Schlegel, Ers., 1837, t. I, p. 132; t. II, p. 39.  
*Ablabes punctatus* Duméril et Bibron, Erp. Gen., 1854, t. VII, part I, p. 310; Günther, Cat. Col. Snakes Brit. Mus., 1858, p. 28.  
*Coluber torquatus* Shaw, Gen. Zool., 1803, t. III, p. 553.  
*Diadophis dysopes* Cope, Proc. Acad. Phila., 1860, 251.

Eastern and Austroriparian regions except Texan District.

**HYPSIGLENA** Cope.

Proc. Acad. Phila., 1860, June, p. 240; Bull. U. S. Nat. Museum 32, 1887, p. 54;  
*Pseudodipsas* Peters, Monatsber. Preuss. Akad. Wiss., 1860, p. 52 (October). *Comastes*, Jan. Elenco Sistemático Ophidi, 1863, p. 102.

Dentition diacranterian; *i. e.*, a long, smooth, posterior maxillary tooth, separated from the anterior by an edentulous space. Pupil elliptic, erect; head distinct, broad posteriorly; body cylindrical. Cephalic shields normal. Two nasals, nostril between; one loreal; two pre- and two postoculars. Scales smooth. Gastrosteges not angulated. Anal and subcaudal scutella divided. Tail not elongate.

This genus includes four species of Central America, Mexico, and parts of the United States adjacent to the latter. They are of small size and resemble considerably the more robust species of *Sibon*. Their vertical pupil indicates that they are of nocturnal habit.

But one species enters the limits of the United States.

*Hypsiglena ochrorhyncha* Cope.

Proc. Acad. Phila., 1860, p. 246; *Hypsiglena chlorophæa* Cope, loc. cit. *Comastes quincunciatus*, Jan, Icon. Gen. Ofid., II, 38 I, Fig. 1.

Sonoran, and Lower Californian regions; Chihuahua.

**PHYLLORHYNCHUS** Stejneger.

Proc. U. S. Nat. Mus., 1891, p. 151.

Head slightly distinct, short; tail short; palatine teeth present; dentition diacranterian; rostral plate greatly enlarged, with free lateral borders and produced backwards so as to separate the supranasals entirely; anal undivided; no scale-pits; pupil vertical; two nasals; loreal present; supralabials not in contact with orbit; one pair of genials only.

This genus is a curious example of those snakes in which the rostral shows a most extraordinary development. In the present instance this shield resembles a thick leaf loosely attached to the front of the snout

and turned over on top of the muzzle. Two species are known, both from the Sonoran region. They differ as follows:

Scales keeled on posterior two-thirds of body; tail one-eighth of total length; about fifteen dorsal and no lateral spots.....*P. brownii*.  
Scales all smooth; tail shorter, about one-twelfth the length; about thirty dorsal spots and one or two rows of lateral spots.....*P. decurtatus*

***Phyllorhynchus brownii* Stejneger.**

Proc. U. S. Nat. Mus., 1890, p. 152.

One specimen from Tucson, Ariz.

***Phyllorhynchus decurtatus* Cope.**

Stejneger, Proc. U. S. Nat. Mus., 1890, p. 154.

*Phimothyrus decurtatus* Cope, Proc. Phila. Acad., 1863, p. 310; *Id.*, Bull. U. S. Nat. Mus., No. 1, pp. 38, 92 (1875); Yarrow, Bull. U. S. Nat. Mus., No. 24, pp. 15, 99 (1885).  
*Salvadora decurtata* Garman, N. Amer. Serp., pp. 39, 145 (1883); *Id.*, Bull. Essex Inst., xvi, p. —; List N. Amer. Rept. Batr., p. 25 (1884); Cope, Bull. U. S. Nat. Mus., No. 32, p. 72 (1887); Bocourt, Miss. Scientif. Mex. Rep., 11 livr., p. 663 (1888).

Lower California.

**DROMICUS Bibron.**

Histoire de l' Isle de Cuba par de la Sagra, 1843, p. 225; Duméril et Bibron Erp. Gen., vii, 1857, p. 646; Cope, Proc. Acad. Phila., 1862, p. 76.

Posterior maxillary tooth longer than the others and separated from them by a space; palatine teeth present. Cephalic plates normal; two nasals and a loreal. Rostral not produced. Scales smooth, without fossæ. Preanal plate divided. Tail elongate. Pupil round.

This genus embraces a dozen species of medium and small size, from the West India Islands, with one species from the southeastern United States. Several species from Mexico are provisionally referred to this genus. The large West Indian species, with double-scale fossæ, formerly referred to *Dromicus*, are Colubrinæ related to *Drymobius*, and form the genus *Alsophis* Cope.

The North American species, *D. flavilatus* Cope, is one of the smaller forms of the genus.

Scales in seventeen rows; superior labials seven; tail entering the length  $3\frac{1}{2}$  times.

Yellowish brown, first two rows of scales yellow-edged; below, and labials white: a brown band from nostril to last labial ..... *D. flavilatus*.

***Dromicus flavilatus* Cope.**

Proc. Acad. Phila., 1871, p. 222; Check List N. Amer. Batr. Rept., 1875, p. 38; Proc. Amer. Philos. Soc., 1878, p. 64; Proc. U. S. Nat. Mus., 1888, p. 386.

From the coast of North Carolina to Florida, inclusive.

**SALVADORA Bd. and Gird.**

Cat. Serp. N. Amer., 1853, p. 104; Cope, Bull. U. S. Nat. Mus., 32, 1887, pp. 57, 72.  
*Phimothyrus* Cope, Proc. Acad. Phila., 1860, 566; Check List, Batr. Rept. N. Amer., 1875, p. 38.

Form elongate, head distinct from body. Cephalic plate normal, except rostral shield, which is expanded laterally with more or less free

margins, and is recurved on the summit of the muzzle. Two nasals. Preocular divided. Scales smooth, bifossate. Anal and subcaudal scutella divided. Teeth larger posteriorly. Pupil round.

This genus is more like the *Lytorhynchus* of Peters, of Africa and the adjacent parts of Asia, and like it, it inhabits, as to its typical form, the *S. grahamiæ*, dry and rocky regions. It has the same peculiar expanded rostral plate as the genus *Phyllorhynchus* Stejn., and displays a similar tendency to division of the lateral head shields. Three species of *Salvadora* are known, all of which are found within the political limits of Mexico, and one of them (*S. grahamiæ*) occurs also in the Sonoran region within the United States.

I proposed (*loc. cit.*) to change the name of this genus, because it had been previously given by Linnæus to a genus of plants. As it is not now regarded as necessary to maintain uniform difference between plant and animal generic names, I have recurred to the name of Baird and Girard.

The species differ as follows:

- I. Tail one-fourth of total length or shorter; superior labial plates eight.

Rostral plate wider, more free laterally; temporal scales 2, 3, 4; bluish or yellowish, with a brown stripe on each side of a yellowish dorsal stripe.

*S. grahamiæ.*

Rostral plate narrower, less free laterally; temporal scales 2, 2, 3; olivaceous, with two brown stripes on each side of a narrow light brown dorsal stripe.

*S. bairdii.\**

- II. Tail one-third length; superior labial plates nine.

Rostral plate narrower, less free at the sides; temporal scales 2-2-2. Yellowish, with two brown bands on each side of a dorsal stripe, anteriorly broken up into parallel narrow lines and crossed by brown cross bars near the head.

*S. mexicana.†*

All of the species have seventeen longitudinal rows of scales.

*Salvadora grahamiæ* Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 104; Baird, U. S. Mex. Bound. Survey, II, 1859, Reptilia, p. 21, Pl. v, Fig. 2; Cope, Bull. U. S. Nat. Mus. 32, 1877, p. 72; Jan, Icon. Gen. Ofidi. Livr. I, Pl. III, Fig. 2.

*Phimothyra grahamiæ* Cope, Proc. Acad. Phila., 1860, p. 304; Check List Batr. Rept. N. Amer., 1875, p. 38.

Considerable variations are presented by this species. Thus in two specimens (4673 and 4470) a narrow brown band extends along the fourth row of scales, in addition to the usual one on each side of the median line. In 4470 and 2082 the superior is partially broken into spots. In No. 9001 the bands are obsolete, being represented by black-

\* *Salvadora bairdii* Jan, Iconografia degli Ofidi Tab. III, p. 52. Specimens in U. S. Nat. Mus. from Orizaba Vera Cruz, West Tehuantepec and Chihuahua; Sumichrast, and Potts; and in Mus. Acad. Phila. from Jalapa, Vera Cruz, Mr. Pease.

† *Salvadora mexicana* D. & B., Cope, Bull. U. S. Nat. Mus., 32, p. 72, 1887; *Zamenis mexicanus* D. & B., Erp. Gen., VII, 1854, p. 695; *Lytorhynchus mexicanus* Cope, Proc. Amer. Philos. Soc., 1869, p. 266; *Coluber mexicanus* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, 148. The last maxillary tooth is separated a little from the others, hence diacranterian.



ish shades at the bases of the scales. Several specimens (2082, 9101, 5347, 12638) have a small loreal below the usual one. In three (2082, 4470, 9101) a second inferior ocular is formed from the summit of the fourth superior labial plate, so that the fifth only enters the orbit. On a specimen of this kind was proposed, the *Phimothyra hexalepis*, which has also wider brown dorsal stripes than any other individual.

The *S. bairdii* resembles this species considerably, but has the rostral plate much narrower, and with more closely appressed edges, quite as in the *S. mexicana*. One or more of the temporal scales of the inferior row is larger than in the *S. grahamiae*. The colors are darker. The *S. mexicana* is a larger species than either of the others, and its general appearance is a mixture of the *Bascanium taeniatum* and the *B. flagelliforme*. The head is longer and flatter than the other species, and the temporal scales are in four vertical rows, the upper row larger.

The *Salvadora grahamiae* ranges from Guaymas, Sonora (Cragin); Batopilas, Chihuahua (Wilkinson); and Cape St. Lucas (Xantus) on the south, to Cottonwood Cañon, Utah, on the north. The locality given on the authority of Yarrow, "Ogden, Utah," requires confirmation, as this is much further north than it is to be looked for.

#### LIOPELTIS Cope.

Proc. Acad. Phila., 1860, p. 559; Bull. U. S. Nat. Mus. 32, 1887, p. 56.

*Chlorosoma* Bd. and Gird. (Wagler), Cat. Serp. N. Amer., 1853, p. 108; not of Wagler.

*Cyclophis* Günther, Reptiles Brit. India, 1864, p. 227.

Head distinct, scuta normal. Rostral plate not modified; one nasal. Teeth equal. Anal and caudal scuta divided. Scales smooth, unifossate (in *L. vernalis*).

This genus includes colubriiform species with a single nasal plate perforated by the nostril, with divided anal plate, and with smooth scales. They are of small and medium size, and are frequently of green color. The headquarters of the genus is in eastern Asia and India, no species existing in Europe or Africa, and but one in North America. Typical Asiatic species are the *L. tricolor* Schleg., *L. calamaria* Günth., and *L. major* Günth.

In North America the genus ranges the entire realm excepting the Pacific and Sonoran regions.

But one species is known in our fauna.

Scales fifteen rows; superior labials seven; postoculars two; temporals 1-2; green above; labials and below pale yellowish green; rather small. . . . . *L. vernalis*.

#### *Liopeltis vernalis* DeKay.

Proc. Phila. Acad., 1860, p. 560; Jan, Icon. Gen. Ofid., II, 3 IV, Fig. 3.

*Coluber vernalis* MSS. Harlan, Journ. Acad. Phila., v, 1827, 361; Med. Phys. Res., 1835, p. 142; Storer, Rept. Mass., 1839, 224; Holbrook, N. Amer. Herpetology, III, 1842, 79, Pl. XVII; DeKay, New York Fauna Rept., 1842, 49, Pl. XI, Fig. 22; Thompson, Hist. Vermont, 1842, 117; *Chlorosoma vernalis* Bd. and Gird., Cat. 1853, p. 108; *Herpetodryas vernalis* Hallow., Proc. Acad. Phila., 1856, p. 243; *Cyclophis vernalis* Günther, Cat. Coluber Snakes Brit. Mus., 1858, p. 119; Cope, Check List Batr. N. Amer., 1875, p. 38.

## CYCLOPHIS Günther.

Cat. Colubrine Snakes Brit. Mus., 1858, p. 119; Cope, Bull. U. S. Nat. Mus. 32, 1887, p. 56; *Ophedryus* Fitzinger, Systema Reptilium 1843, p. 26, *nomen nudum*; Cope, Proc. Acad. Phila., 1860, 560, *Phyllophyllophis* Garman, Memoirs Museum Comp. Zoölogy, Cambridge, 1883, p. 146.

Head distinct, scuta normal. One nasal plate, one preocular. Teeth equal, smooth. Anal and caudal scuta divided. Scales keeled, bifosate (*C. æstivus*).

This genus is found in temperate North America only. In the nearctic realm its range is mainly the Austroriparian region; but it has been taken in the southern part of the central region, and it ranges also the Carolinian district of the eastern region. But one species is known, which is characterized as follows:

Scales in seventeen rows; superior labials seven; temporals 1-2; tail two and one-half times in total length. Green above; labials and below light yellow.

*C. æstivus*.

*Cyclophis æstivus* Linn.

Günther, Cat. Coluber Snakes Brit. Mus., 1858, xi; Cope, Check List. N. Amer. Batr. Rept., 1875, p. 38.

*Coluber æstivus* Linn., Syst. Nat. i, 1766, p. 387; Gmelin, Syst. Nat., ed. xiii, i, iii, 1788, p. 1114; Harlan, Jour. Acad. Phila., v, 1827.

*Leptophis æstivus* Bell, Zoöl. Journ., ii, 1826, 329; Holbrook, N. Amer. Herpetol., iii, 1842, p. 17, Pl. iii; Bd. and Gird., Cat. 1853, p. 106.

*Herpetodryas æstivus* Dum. and Bibr. Erp. Gen., vii, p. 209, 1854.

*Ophedryus æstivus* Fitz., Cope, Proc. Acad. Phila., 1860, p. 560; *Cyclophis* (*Phyllophyllophis*) *æstivus* Garman, Mem. Mus. Comp. Zoöl. Cambr., viii, 1883, p. 146.

*Anguis viridis* Catesby, Nat. Hist. Carolina, ii, 1743, p. 57, Pl. vii.

Austroriparian and part of Eastern region.

## BASCANIUM Bd. and Gird.

Cat. Rept. N. Amer., Pl. i, Serpents, 1853, p. 93; Cope, Check List Batr. Rept. N. Amer., 1875, p. 40; Bull. U. S. Nat. Mus. 32, 1887, p. 56; *Coryphodon* Duméril and Bibron, Erpet. Gen., vii, 1854, p. 181; not of Owen, 1846; *Masticophis* Bd. and Gird. Cat. Lc., 1853, p. 98. *Coluber* Duméril Prodrôme, 1852; Garman, 1863.

Head distinct; cephalic plates normal. Teeth increasing gradually in size posteriorly; not grooved. Scales smooth, in an odd number of series, with two apical fossæ. Subcaudal scutella in two series; anal plate divided. Two preoculars; loreal present; two nasal plates. Form elongate.

The species of this genus are elongate in form, and active in movement, so that the popular names of "whip snake" and "racer" are appropriate. Although at home on the ground they climb bushes and low trees, though they rarely ascend to any great height. They are skillful in capturing young birds, as well as small mammals and reptiles. They are distributed over all North America south of the Boreal region, and are represented, like most of our other genera of snakes, by a greater multiplicity of form in the southwestern section of the continent. One species inhabits Mexico exclusively.

The young individuals of this genus frequently differ in coloration from the adults, and the species may be arranged in two series according to the coloration of the young, as follows:

(1) Young transversely spotted or banded. *B. constrictor*; *B. flagelliforme*.

(2) Young longitudinally striped. *B. semilineatum*; *B. laterale*; *B. schottii*; *B. tæniatum*.

Of the second series all retain the striped coloration to maturity, excepting the *B. semilineatum*, where a trace only remains on the anterior part of the body. The general characters of the species are as follows:

- I. Scales in seventeen rows; superior labials seven. (Frontal plate nearly as wide as superciliaries posteriorly; muzzle rather produced; colors not in stripes.)  
Two labials bounding orbit below; form robust; colors generally uniform; always so on lips and throat.....*B. constrictor*.  
One labial bounding orbit below; form more slender; more or less spotted on the lips and throat.....*B. mentorarium*.
- II. Scales in nineteen rows; superior labials eight. (Frontal plate one-half as wide as superciliary behind; muzzle narrowed, produced.)  
Slender; above, black; below, yellow.....*B. picum*.
- III. Scales in seventeen rows; superior labials eight. (Frontal plate one-half width of superciliaries posteriorly; form slender.)  
Muzzle narrowed, more or less decurved; without, or with dark shades or spots anteriorly; young cross-spotted.....*B. flagelliforme*.  
Muzzle narrowed; pale with a lateral brown stripe anteriorly; no temporal spot; young striped.....*B. semilineatum*.  
Muzzle flattened, wider; a continued yellow stripe on third and fourth rows of scales only; dorsal scales brown; a yellow temporal spot; belly yellow.  
*B. laterale*.
- IV. Scales in fifteen rows; superior labials eight. (Form slender; color in stripes.)  
Muzzle elongate, narrow; frontal plate more than half as wide as superciliaries posteriorly; two lateral yellow stripes on a dark ventral and dorsal ground; dorsal scales yellow-edged; no temporal spot.....*B. schottii*.  
Muzzle elongate, flattened; frontal half as wide as superciliary behind; reddish brown above and below, with two yellow stripes as in *B. schottii*, that on the third and fourth rows black-edged and split by a black line; colors above alternately transversely darker and paler.....*B. ornatum*.  
Muzzle depressed, short; frontal plate half as wide as superciliaries posteriorly; brown above to fourth row of scales; below and sides, yellow; latter with four or five lines on middles of rows of scales.....*B. tæniatum*.

Some of the species above admitted are nearly allied, and young specimens are sometimes not readily referred to their proper places. In the first place, although the eyes of young vertebrata are relatively larger than those of the adult, yet the superciliary plates in this genus encroach more on the frontal in mature than in young specimens, so that in the former the frontal plate is more narrowed posteriorly than in the latter. The color characters of young individuals of the *B. laterale* and *B. tæniatum* are sometimes not fully developed, so that their reference is difficult. In all of the species the head plates are pale-bordered in the young, and this character may or may not continue to maturity in the *B. tæniatum*. The *B. constrictor* and *B. flagelliforme* are cross-banded

and spotted in youth, but this character disappears except on the anterior dorsal region of the latter species, where it is frequently retained.

The species are distributed as follows :

Regions—Eastern, *B. constrictor* ; Austroriparian, *B. constrictor*, *B. flagelliforme* ; Central, *B. constrictor*, *B. tæniatum* ; Pacific, *B. constrictor*, *B. flagelliforme*, *B. tæniatum*, *B. laterale* ; Sonoran, *B. flagelliforme*, *B. semilineatum*, *B. piceum*, *B. schottii*, *B. laterale*, *B. ornatum*, *B. tæniatum* ; Mexican, *B. mentovarium*.

The number of rows of scales is very constant. Apparent exceptions are referred to under the head of *B. laterale*. The number of labial scuta is very constant except in the Californian representatives of the *B. constrictor*. The small inferior preocular plate is very constant in Bascanium, its only absence being noticed in a very few specimens of the Californian form of *B. constrictor*. The temporal scales are always normally 2-2-2, and rarely vary from it.

The anterior and posterior parts of the body are frequently differently colored in this genus. This is especially the case with the *B. flagelliforme*, *B. semilineatum*, and *B. ornatum*, where the posterior region is paler than the interior and lacking in the pattern. In the *B. constrictor* the transition from the black to the green variety is first seen in fading out of the black on the tail and posterior part of the body.

As regards the striped forms, we have evidence how the young differ from the adult in the *B. semilineatum* and the *B. tæniatum*. In these the tendency to form distinct wider bands is stronger than in the adult, where they are subdivided and more or less obliterated. Thus the young of both these forms resemble more the *B. laterale* than do the adults. We may then regard the *B. laterale* as representing a primitive form for this series. The primitive form for *B. flagelliforme* and *B. constrictor* was probably a cross-banded form, but no such species is known. In this respect the last named species resemble those of the genus *Drymobius*, where the young are cross-banded or spotted. Some *Drymobii* are known where the adults are cross-spotted.

The remains of a Bascanium were found by Mr. C. M. Wheatley in the bone cave at Port Kennedy, Pennsylvania, which furnished so many species of extinct mammalia.

*Bascanium constrictor* Linn.

Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 93; Cope, Check List Batr. Rept. N. Amer., 1875, p. 40.

*Coluber constrictor* Linn., Syst. Nat., I, 1766, p. 385; Gmelin, Linn. Syst. Nat., XII, I, iii, 1788, p. 1109; Harlan, Journ. Acad. Phila., V, 1827, p. 348; Schleg. Ess. Phys. Serp., 1837, p. 133, Pl. V, Figs. 3-4; Storer Report Rept. Mass., 1839, p. 225. Holbrook, N. Amer. Herp., III, 1842, p. 55, Pl. XI; Thompson, Hist. Vermont, 1842, p. 117; Dekay, New York Fauna, Rept. 1842, p. 35, Pl. X, Fig. 20; Garman, Memoirs Mus. Comp. Zool., Cambridge, VIII, 1883, p. 147.

*Hicropkhis constrictor* Bonap., Fauna Italica, II, 1841, nomen nudum.

*Coryphodon constrictor* Dum. and Bibr., *Erp. Gen.*, vii, 1854, p. 183; Günther, *Cat. Col. Snakes Brit. Mus.*, 1858, p. 108; Jan. *Icon. Gen. Ofid.*, ii, 22, iii, Fig. 2; iv, Fig. 2; iii, 48, iii, Fig. 17.

*Coluber flaviventris* Say, in Long's *Exped. Rocky Mts.*, ii, 1823, p. 185.

*Coryphodon constrictor* var. *flaviventris* Jan. *Icon. Gen. Ofid.*, ii, 22, iii, Fig. 1; iii, 48 vi, Fig. 2.

*Bascanium fremontii* Bd. and Gird., *Cat. Serp. N. Amer.*, 1853, p. 95.

*Bascanium foxii* Bd. and Gird., l. c. 96.

*Bascanium vetustum* Bd. and Gird., l. c. 97; Girard, *U. S. Expl. Exped.*, 1858, p. 127, Pl. vii, Figs. 12-19; Cooper, *Pac. R. R. Report*, xii, Pl. ii, 1860, p. 301.

*Bascanium constrictor* var. *vetustum* Cope, *Check List Batr. Rept. N. Amer.*, 1875, p. 40; Yarrow, *U. S. G. Surv. W. of 100th Mer.*, v, 1875, p. 241.

*Coryphodon constrictor* var. *vetustus* Jan, *Icon. Gen. Ofid.*, ii, 22, iv, Fig. 1.

*Bascanium anthicum* Cope, *Proc. Acad. Phila.*, 1862, p. 338.

Transitions between the eastern black and the western green forms of this species are frequently met with in the region connecting the two habitats. Thus, in Michigan the species is generally of a bluish green or greenish blue tint above, and is known as the "blue racer." Similar specimens are in the National Museum from New Orleans. On the yellow-bellied form of the plains, Say proposed his *Coluber flaviventris*, which was regarded as a distinct species by Hallowell and by Baird and Girard. I, however, do not find it to be more than a geographical color race. The same color characterizes specimens from the Pacific district, which are also inferior in size to Eastern individuals, and frequently have the head a little shorter. In spite of this fact they incline to develop an additional labial plate, the number being occasionally in this region eight on one or both sides. Thus, of eleven black Eastern specimens only two have 8 superior labials on both sides. Of twenty-two yellow-bellied specimens, three have the labials, 7 on one side and 8 on the other, and nine have 8 on both sides. Of the twelve specimens thus exceptional, seven are from the Pacific region and five from the Great Basin of Nevada and Utah, of the central region. This is the *Bascanium vetustum* of Baird and Girard. In the type specimens the sixth labial reaches the lower postocular; but this is exceptional and rarely occurs in California or other individuals.

A remarkable color variety of this species was described by me under the name of *Bascanium anthicum*. In this form the general color is as in the dark bluish tinted variety, but numerous scales on all parts of the body are a bright yellow. The yellow scales are rarely regularly arranged, but sometimes show a tendency to a distribution in chevron-shaped cross-bands. A specimen of this kind was sent me by my friend, Prof. Pendleton King, as from near Baton Rouge, Louisiana. The typical specimen, which is in the National Museum, is of uncertain locality, but was alleged to have been brought from Siam, most probably erroneously.

A black *Bascanium* was described by Baird and Girard as having been brought from California, under the name of *B. fremontii*. The specimen is a typical *B. constrictor*, and was taken probably to the eastern region. The *B. foxii* Baird and Girard is the same.

The length and diameter of the tail vary considerably, some being quite slender and others quite robust. Of the slender-tailed forms, two (8298 and 4488) are males. The sex of the others is unknown, but I suspect the specimens with thick tails to be females. The lengths are as follows: *I. B. c. constrictor*:  $3\frac{1}{2}$  in total length, No. 8298;  $3\frac{3}{8}$ , 4447;  $3\frac{3}{8}$ , 11440;  $3\frac{3}{8}$ , 1764, 4448;  $4\frac{1}{8}$ , 7194, 1788, 4444;  $4\frac{3}{8}$ , 10650. *B. c. flaviventrie*:  $3\frac{3}{8}$ , 10717;  $3\frac{3}{8}$ , 12588;  $3\frac{1}{8}$ , 4418;  $3\frac{3}{8}$ , 2132; 4, 1741;  $4\frac{1}{10}$ , 7812;  $4\frac{1}{8}$ , 7812b;  $4\frac{3}{8}$ , 12581.

*Bascanium piceum* Cope.

*Bascanium flagelliforme piceum* Cope, in Yarrow's Rept. U. S. G. G. Surv. W. of 100th Mer., 1875, v., p. 617 (name only); Check List N. Amer. Batr. Rept., 1875, p. 40.

Form elongate, tail  $3\frac{1}{2}$  times in the total length. Head elongate, muzzle narrowed forwards, moderately protuberant, not flattened, slightly decurved. Rostral plate slightly recurved above; internasals longer than wide. Frontal half as wide as superciliaries behind. Parietals openly truncate emarginate at posterior margin. Loreal large, larger than high. Temporals 2-2-2. Superior labials 8, fourth and fifth bounding orbit, sixth subtriangular, seventh and eighth larger and nearly equal, and longer than high. Inferior labials 10, fifth longest; postgeneials not longer than pregeneials. Scales in nineteen longitudinal rows, moderately narrowed.

Gastrosteges, 195; anal, 1; urosteges, 108. Total length, 1,263 millimeters; the tail, 355 millimeters; end of muzzle to rictus oris, 34 millimeters.

Color above, to and including the extremities of the gastrosteges, black. Inferior surfaces, light yellow; the anterior fifth of the length with brownish blotches, which are posteriorly few and distant, but become larger and more approximated, until the anterior thirty to forty gastrosteges are brown or anteriorly black, like the superior surfaces. Labial plates with some pale shades in their middles. Preocular with a light middle; postoculars black. Top of head a little paler than back.

This form might be regarded as a melanistic *B. flagelliforme* but for the increased number of scale rows and longer tail. The fact that the inferior surface does not generally take part in the darkened color indicates a normal color type.

*Bascanium piceum* Cope.

Catalogue No.	No. of specimen.	Locality.	From whom received.	Character.
7891	1	Camp Grant, Arizona .....	Dr. E. Palmer.	Alcoholic.

*Bascanium flagelliforme* Catesby.

*Bascanium flagelliforme flagelliforme* Cope, Check List Batr. Rept. N. Amer., 1875, p. 40.

*Anguis flagelliformis* Catesb., Nat. Hist. Coral, II, 1743, p. 54, Pl. LIV.

*Coluber flagellum* Shaw, Gen. Zoöl., III, 1802, p. 475.

*Coluber flagelliformis* Holbr., N. Amer. Herpet., I, 1836, p. 107, Pl. XIX; Garman, Mem.

Mus. Comp. Zoöl. Cambr., VIII, 1883, p. 147.

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- Psammophis flagelliformis* Holbrook, N. Amer. Herpt., 2d ed. III, 1842, p. 11, Pl. 2.  
*Masticophis flagelliformis* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 98; Jan. Icon. Gen. Ofid., II, 20, VI, Fig. 1.  
*Herpetodryas flagelliformis* Dum. and Bibr. Erp. Gen. VII, 1854, p. 210; Günther, Cat. Col. Snakes Brit. Mus., 1858, p. 118.  
*Coluber testaceus* Say, Long's Exped. Rocky Mts., 1823, p. 48; Holbr. N. Amer. Herpet., III, 1842, p. 63; Harlan, Journ., Acad. Phila., V, 1827, p. 348.  
*Masticophis testaceus* Bd. and Gird., Baird, U. S. Mex. Bound. Surv., II, Pt. II, Reptiles, p. 20, Pl. XVI.  
*Bascanium flagelliforme testaceum* Cope, Check List N. Amer., Batr. Rept., 1875, p. 40.  
*Masticophis flagelliformis* var. *testaceus* Jan, Icon. Gen. Ofid. II, 20, VI, Fig. 2.  
*Herpetodryas psammophis* Schleg. Ess. Physion. Serpens., II, 1837, p. 195.  
*Psammophis flavigularis* Hallow., Proc. Acad. Phila., 1852, p. 178.  
*Masticophis flavigularis* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 99.  
*Herpetodryas flavigularis* Günther, Cat. Col. Snakes Brit. Mus., 1858, p. 118; Hallow., Rept. U. S. Pac. R. R. Surv., x. 1859, Williamson's Rept. p. 12.

The color varieties of this species are as follows: In half-grown eastern specimens the head is light brown, with darker cross shades on the head and nape. In adult eastern specimens the head and from one-fourth to two-thirds the length of the body are deep brown. In Texas adult specimens the anterior regions are sometimes of a strong brown color, but generally they are pale, the top of the head only being of a light brown. In adults from the Sonoran and Pacific regions the posterior part of the head and several wide cross bands on the nape are of a dark brown or even of a blackish color. In specimens from Arizona these are followed by pink cross bands, which appear only on the anterior fourth or fifth of the body. In Californian specimens in the National Museum these pink cross bands indistinctly appear. In specimens from La Paz, at the southern extremity of Lower California, the entire body is a citron yellow, with some black appearing between the scales when the skin is stretched. The head and nape are spotted as in the Californian individuals. In young specimens from Georgia and Florida, as well as from the West, the chin, throat, and anterior part of the belly for a short distance are spotted by ill-defined spots of light brown. These are represented by cloudy shades, or are entirely lost in the prevailing brown color in eastern adult specimens. In Texas specimens they disappear entirely in some large adults. In Sonoran and Californian specimens they continue permanently, the spots forming a row on each side of the inferior and superior labials, and the speckled brown of the temporal region is divided by a pale line extending from the eye posteriorly.

This species ranges from South Carolina into Mexico on the plateau, and southward on the western slope. Thus I have recorded it from Chihuahua, Guanajuato, and Guadalajara.

*Bascanium semilineatum* Cope.

This is a remarkable form, as it occupies a position between several of the species. Thus it has the scale formula and shape of head of *B. flagelliforme*, the head coloring of *B. schottii*, and part of the color-

tion between those of *B. tæniatum* and *B. laterale* and part like that of *B. flagelliforme*. Its characters ally it most nearly to the last named, but its appearance is quite distinct.

The scales are in seventeen rows, and there are eight superior labials. The posterior part of the frontal is only half as wide as the superciliary plate at the same point. The temporal scales are 2-2-2. The fourth and fifth labials bound the orbit below. The loreal is longer than high. The postgenials are a little larger than the pregenials. The muzzle is not decurved, and is moderately protuberant viewed in profile; from above it is elongate wedge-shaped. The tail is long, entering the total length in the specimen before me (No. 1981) three and one-seventh times.

The general color is a light-brownish clay-color (in spirits), the free border of each scale with an elongate whitish spot on each side. The color becomes darker anteriorly, so as to be on the anterior fourth of the length a plumbeous green with the top of the head light brown. There are no markings on the superior surface of this region, but the sides are striped, the stripes disappearing on the second fourth of the length of the body. These stripes are bounded by a brown line on the middle of each scale of the second and third rows. Between these the color is like that of the back, while the adjacent halves of the third and fourth rows are light yellow. A fainter brown line runs along the middle of the first row. Belly and throat immaculate light yellow, except a few punctæ along the ends of the first dozen gastrosteges. Middles of nasal, loreal, preocular, and postocular plates, yellow. Superior labials yellow, with a blackish superior border extending from the rostral plate back. Temporal region, like the top of the head, immaculate. A few black specks on the genial margins of the inferior labials.

Gastrosteges 201; anal 1; urosteges 134+. Total length (No. 1981) 1185 millimeters; of tail (extremity wanting) 375 millimeters.

A young specimen (No. 8434) is interesting as showing the constancy of the color characters as compared with those of corresponding age of the *B. tæniatum*, and with the adult *B. schottii* and *B. laterale*. In the first place the stripes are much more distinct in this specimen than in the adults, as is the case also with the *B. tæniatum*. Moreover, they extend farther along the length of the body, being traceable on the middle third, though they are wanting posterior to it. The stripes are: a yellow one on adjacent parts of the third and fourth rows, bounded below by a brown one on the adjacent parts of the second and third rows. A yellow stripe succeeds on the adjacent parts of the first and second rows, while another and paler brown stripe runs on the adjacent parts of the first row and the extremities of the gastrosteges. This pattern, it will be observed, is quite different from that which obtains in any of the other striped species, as the *B. tæniatum*, *ornatum*, *schottii*, or *laterale*. The head is entirely uniform greenish slate-color above and on the temples. The superior labials are yellow, the posterior bounded



above by a black line from the orbit to the neck. The muzzle of this specimen is broken off.

This species presents the interesting peculiarity of resembling another species (*B. flagelliforme*) much more in the adult than in the young stage. The young of the two species refer them to different sections of the genus, while the adults are distinguishable only on careful examination.

*Bascanium semilineatum* Cope.

Catalogue No.	No. of specimens.	Locality.	Whence obtained.	Character.
1981	3	Colorado River, Arizona.....	A. Schott.....	Alcoholic. Do.
8434	1	Camp Grant, Ariz.....	— Butter .....	

*Bascanium laterale* Hallow.

*Bascanium taniatum laterale* Cope, Check List Batr. Rept. N. Amer., 1875, p. 40; *Leptophis lateralis* Hallowell, Proc. Acad. Phila., 1853, p. 237; U. S. Pac. R. R. Report, x, 1859; Williamson's Report, p. 13, Pl. iv, Fig. 3.

This handsome species has two strongly marked subspecies, which may prove to be deserving of the rank of two species. The decision of this question must depend on future material.

The range is southern California and Arizona to the extremity of Lower California.

The subspecies are as follows:

Lateral stripe continuous to origin of tail; throat and upper and lower labials spotted; posterior upper labials less elongate..... *B. l. laterale*.  
Lateral stripe broken up on anterior fourth of length, after which a trace only remains; labial plates and throat unspotted; posterior lateral plates more elongate.  
*B. l. aurigulum*.

*Bascanium laterale laterale* Hallow.

*Leptophis lateralis* Hallowell, l. c. *Bascanium taniatum laterale* Cope, l. c.

The seventeen rows of scales, together with the coloration, distinguish this form from the *B. schottii* and the *B. taniatum*. Young specimens of the latter, however, resemble it closely, since the spaces between the dark lines of the first, second, and third rows are apt to be solidly dark-colored at that age. They may be distinguished, apart from the smaller number (15) of scale rows, by the different distribution of the lateral stripes. In *B. l. laterale* the yellow stripe extends to the fifth row of scales, and the inferior band only reaches to the middle of the first row, not attaining the gastrosteges. In *B. schottii* the superior lateral stripe is as in *B. l. laterale*, but the belly is dark, and there is a yellow stripe on the adjacent edges of the gastrosteges and first row of scales. The head is unicolor, and not spotted as in the *B. l. laterale*. The yellow temporal spot of both forms of the *B. laterale* is to be noted as always absent from the allied species. The *B. semilineatum* agrees with the *B. laterale* in the possession of seventeen rows of scales, and the young is more fully striped than the adult. It may be distin-

guished at all ages by the arrangement of the lateral stripes and the uniform coloration of the head. The yellow stripe is, like that of the *B. laterale*, on the third and fourth rows only, but the dark band below it only occupies the adjacent parts of the second and third rows, instead of extending to the gastrosteges. There is a yellow band on the adjacent parts of the first and second rows, which is absent in the *B. laterale*, and there is a dark stripe on the adjacent parts of the first row and the gastrosteges, where the inferior yellow stripe is present in the *B. schottii*. The belly is light, and not dark, as in the last-mentioned species.

Southern California and Arizona.

*Bascanium laterale aurigulum* Cope.

*Bascanium aurigulum* Cope, Check List Batr. and Rept. N. Amer., 1875, p. 40. *Drymobius aurigulus* Cope, Proc. Acad. Phila., 1861, p. 301.

Lower California.

*Bascanium schottii* Bd. and Gird.

*Masticophis schottii* Bd. and Gird., Cat. Rept. N. Amer., Pt. I, Serpents, 1853, p. 160; Baird, U. S. Mex. Bound. Surv., II, Reptiles, 1859, p. 20, Pl. XVIII.

Several specimens of this species confirm the constancy of its characters.

Bio Grande Valley.

*Bascanium ornatum* Bd. and Gird.

*Masticophis ornatus* Bd. and Gird., Cat. Serpt. N. Amer., 1853, pp. 102, 159. *Bascanium tæniatum ornatum* Bd. and Gird., Cope, Check List Batr. Rept. N. Amer., 1875, p. 40.

Western Texas.

Although this species has the scale formula and some resemblance in coloration to the *B. tæniatum*, I can not now refer it to that species. The head is elongate with narrow protuberant muzzle, more like the *B. flagelliforme* and *B. laterale*. The *B. ornatum* displays the unusual peculiarity of a striped species with a tendency to become annulate.

*Bascanium tæniatum* Hallow.

Cope, Check List N. Amer. Batr., Rept., 1875, p. 40; *Leptophis tæniata* Hollowell, Proc. Acad. Phila., VI, 1852, p. 181.

*Masticophis tæniatus* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 103; Jan. Icon. Gen. Opid., II, 22, v, Fig. 1.

Sonoran region to Salt Lake; Pacific region to northern California.

A young specimen (3123) has the tendency to a yellow stripe on the third, fourth, and fifth rows of scales above referred to, well marked. The head shields above have narrow pale margins. The frontal plate is not so narrow posteriorly as in the adult from the same and other localities. Still younger individuals (Nos. 1982 and 11423) have the

lateral yellow stripe more distinct by the suffusion of the third, second, and half the first rows with brown, thus producing an appearance much like that of the *B. laterale*. But only the third and fourth rows bear the yellow stripe, and the brown band covers the ends of the gastrosteges in that species. It was this resemblance that induced me to combine the two species, with the remark (Proc. Acad. Phila., 1866, p. 305) "The young of the form *lateralis*, the adult, the *tæniatus*."

The measurements of the tail in nine specimens are as follows :

Three and one-seventh times in total length, Nos. 8432 and 4384;  $3\frac{1}{2}$ , 9520, 8120, and 11422;  $3\frac{1}{4}$ , 13618 and 1979;  $3\frac{1}{4}$ , 8122;  $3\frac{1}{2}$ , 1983.

#### COLUBER Linn.

Systema Naturæ, ed. xii, 1766, p. 377, pt. ; Oppel, 1811, pt. Boie, Isis von Oken; 1827, p. 209; Günther ex Linn., Cat. Snakes Brit. Mus., 1858, p. 87; Cope, Check List N. Amer. Batr. Rept., 1875, p. 39; Proc. U. S. Nat. Mus., 1888, p. 390. *Calopeltis* Bonap., Mem. Real. Acad. Torino (2), II, 431, 1840. *Scotophis* Bd. and Gird., Cat. N. Amer. Rept., Serpents, 1853, p. 73. *Natrix* Cope ex Laurenti, Proc. Acad. Phila., 1862, p. 338; Cat. Batr. Rept. Centr. Amer., Mex., 1887, pp. 66-71.

Colubrid snakes, with equal teeth, subcylindric body, and two rows of caudal scutella. The pupil round; the rostral and nine superior cephalic shields normal; two nasal and one preocular plate. Two pairs of geneials; scales of the body with two apical pits, keeled or rarely smooth. Preanal shield divided.

This genus embraces a number of species of the northern temperate regions of the world. Six species belong to Eurasia and ten to North America. Three others extend to within the tropics of Mexico and Central America.

The North American species are of inoffensive habits, but are destructive to birds and small mammals. Some of them reach considerable dimensions, but they are exceeded in this respect by some of the species of the allied genus *Spilotes*. The *C. guttatus* and *C. rosaceus* are of brilliant colors.

The North American species are closely allied, and form gradations of characters which must be carefully estimated in order to learn the definitions. It is not difficult to distinguish the *C. vulpinus*, *C. guttatus*, and *C. emoryi*, but the group of which the *C. spiloides* is the type is more difficult to unravel. It embraces that species, *C. confinis*, *C. quadrivittatus*, *C. obsoletus*, and *C. letus*. All the North American species (except, possibly, *C. confinis*, of which but one specimen is known) have twenty-seven rows of scales, some species (*C. vulpinus*) varying to twenty-five, and others (*C. emoryi*) varying to twenty-nine. The most important characters are the number of rows of scales which are keeled, and the length of the tail, as indicated by the number of urosteges. The coloration has a typical value, but displays many transitions, especially in the *spiloides* group.

I present a synopsis of the principal characters in the following table. Three neotropical species are included in it :

## Three neotropical species are included in it:

- I. One plate in the first row of temporals.  
Scales twenty-five rows, eleven keeled; caudal scutella? Head not banded; dorsal spots; belly partly spotted ..... *C. confinis*.
- II. Two plates in the first row of temporals.  
a. Parietal plate shorter than muzzle, measured from front of frontal plate.  
About nine rows of keeled scales; caudal scutella not over sixty-eight; head not banded; above with rounded black spots; belly tessellated with black ..... *C. vulpinus*.  
aa. Parietal plate longer than or equal muzzle.  
β. Eight superior labials.  
Scales smooth; scutella?; head not banded; belly not spotted; above with wide red spots which are crossed by four longitudinal bands ..... *C. rosaceus*.  
Five rows of scales weakly keeled; scutella not exceeding seventy-one; above with angular red spots; head banded; belly tessellated ..... *C. guttatus*.  
About thirteen rows of keeled scales; scutella not exceeding 102; above with four longitudinal bands, the medium pair often connected by spots; head not banded; belly obscurely clouded ..... *C. quadrivittatus*.  
Keeled rows seven to eleven; scutella not over ninety-six; above with brown, spots, angular anteriorly, and elongate spots on sides; head not banded in adult; belly clouded ..... *C. spiloides*.  
Keeled rows seventeen; scutella not above ninety-two; above black or brown, without or with darker spots; head not banded; belly very darkly colored.. *C. obsoletus*.  
ββ. Nine superior labials.  
Five rows of scales keeled; scutella ninety-nine; postgenials transversely divided; above with narrow transverse spots, below clouded; prefrontal and postorbital head-bands ..... *C. bairdii*.
- III. Three plates in first row of temporals.  
Keeled rows fifteen; scutella seventy-seven; dorsal spots twenty-nine, longer; parietal and prefrontal head-bands obscure; no postocular band; belly colored ..... *C. letus*.  
Scales smooth; scutella seventy-eight; dorsal spots shorter, 33-45; headbands, with postocular distinct; belly tessellated ..... *C. emoryi*.  
Scales 27-29 rows; nine superior labials; dorsal and lateral spots large and close together, not becoming obsolete; head red above, with light postocular band, and spot on nape ..... *C. flavirufus*.  
Scales in 31-33 rows; eight upper labials; dorsal and lateral spots smaller and separated; three bands behind frontal region, all markings disappearing at maturity ..... *C. mutabilis*.†
- IV. Four plates in first row of temporals.  
Scales in thirty-five rows; two or three loreals; eight upper labials; dorsal and lateral spots smaller, separated; three longitudinal bands from frontal region ..... *C. triaspis*.†

As regards the characters above enumerated, I will remark, that in a single specimen of the *C. spiloides* there is a rudimental third temporal in the first row on each side, one of which is intercalated between the two postoculars. In some specimens of *C. guttatus* there are no keels

\* COLUBER FLAVIRUFUS Cope, Proc. Acad. Phila. 1866, p. 319; Mexico.

† COLUBER MUTABILIS Cope, Proc. Amer. Philos. Soc. 1834, p. 175; Mexico and Guatemala.

• COLUBER TRIASPIS Cope, Proc. Acad. Phila., 1866, p. 123; Belize.

on any o. the dorsal series of scales; and in one of *C. emoryi* a few dorsal rows have faint traces of keels. In a specimen of the *C. obsoletus* (No. 5503) there are but sixty urosteges, the smallest number known in any other individual being seventy-four. This is abnormal. The young of the *C. quadrivittatus* are strongly spotted, and closely resemble the *C. spiloides*, as is also the case with the young of the *C. guttatus*. In the young of *C. emoryi*, there are seldom more than two scuta in the first row of temporals, the division into three being accomplished at a later stage of growth. The general result of these facts is that the *C. spiloides* is the primitive type from which the other species have been derived, some by one modification, some by another.

Günther retained the Linnæan name *Coluber* for this genus, as he was compelled to do in view of the use of it by his predecessors, Boie and Fleming.

*Coluber confinis* Bd. and Gird.

*Scotophis confinis* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 76.

Mississippi.

*Coluber vulpinus* Bd. and Gird.

Cope, Check List Batr. Rept. N. Amer., 1875, p. 39.

*Scotophis vulpinus* Bd. and Gird. Cat. Serpt. N. Amer., 1853, p. 75.

*Elaphis rubriceps* Dum. Bibr. Erp. Gen. VII, 1854, p. 270.

Upper Mississippi River and Great Lakes to western New York.

*Coluber guttatus* Linn.

Syst. Nat. I, 1766, p. 385; Gmel., Linn., Syst. Nat., Ed. XIII, iii, 1788, 1110; Daubenton, Quart. Serp., p. 602; Lacep., Quadr. Ovip. Serp. II, p. 329; Bonnaterre, Ophiol., p. 19; Harlan, Journ. Acad. Phila., v, 1827, 363; Schleg., Essai. Phys. Serp. 1837, p. 168; Holbrook, N. Amer. Herp. II, 1832, p. 109, Pl. XXIV, and 2d Ed. III, 1842, p. 65, Pl. XIV; Günther, Cat. Col. Snakes, Brit. Mus., 1858, p. 89; Cope, Check List Batr. Rept. N. Amer., 1875, p. 39; Merrem, Tentamen, 1820.

*Scotophis guttatus* Bd. and Gird., Cat. Serpt., 1853, p. 78.

*Elaphis guttatus* Dum. Bibr., Erp. Gen. VII, 1854, p. 273; Garman Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 152; Jan, Ican. Gen. Oïd. II, 21, vi, Fig. 1.

*Coluber compressus* Merrem, Beitr., ii, Pl. 11.

*Coluber carolinianus* Shaw, Zool., iii, p. 460, Pl. 119.

*Coluber maculatus* Latreille, Rept. IV, p. 73; Merrem, Tent.; Harlan, Journ. Acad. Phila., 1827, 360.

*Coluber pantherinus* Merr., Tent.

*Coluber floridanus* Harlan, Jour. Acad. Phila., 1827, 360.

Two plates in the first row of temporals; parietal plate longer than muzzle measured from front of frontal plate. Scales in twenty-seven or nine rows, only five rows of scales keeled, and these weakly. Eight superior labials, fourth and fifth entering orbit. Orbitals 1-2. Tail short, the scutella not exceeding seventy-one in number; gastrosteges 215-35.

Light reddish brown, with angular bright brick-red spots above. Head with brick-red bands, arranged en chevron, the angle anterior, with blackish borders. Below, white tessellated with black.

This handsome species is represented by two well-marked subspecies, which differ as follows:

Scales in twenty-seven rows; head bands present; dorsal spots narrow, extending over ten to fifteen rows, and with one or two rows of lateral spots on each side..... *C. g. guttatus*.

Scales in twenty-nine rows; head bands, excepting the postocular, wanting or rudimentary; dorsal spots wider, covering nineteen to twenty-one rows of scales; no lateral spots..... *C. g. sellatus*.

This species ranges the Austroriparian region east of the Mississippi River and the Carolinian district of the Eastern, not, however, entering New Jersey. The subspecies *C. g. sellatus* is restricted to Florida. It is one of our most brilliantly colored species, and is of inoffensive manners. It is altogether terrestrial in its habits.

***Coluber guttatus guttatus* Linn.**

Loc. cit. Harl., Schleg., Holbr., Günth., Cope., l. c.

*Scotophis guttatus* Bd. and Gird., l. c.

*Elaphis guttatus* Dum. Bibr., l. c.

*Coluber compressus* Merrem., l. c.

*Coluber carolinianus* Shaw, l. c.

*Coluber maculatus* Latr. Merr. Harlan, l. c.

*Coluber pantherinus* Merr., l. c.

*Coluber floridanus* Harlan, l. c.

Virginia to Florida and Mississippi, inclusive.

***Coluber guttatus sellatus* Cope.**

Proc. U. S. Nat. Mus., 1888, p. 387.

Florida.

***Coluber rosaceus* Cope.**

Proc. U. S. Nat. Mus., 1888, p. 388, Pl. xxxvi, Fig. 3.

Florida (Key West).

***Coluber quadrivittatus* Holbr.**

N. Amer. Herp., III, 1842, p. 89, Pl. xx; Günther, Cat. Coluber Snakes Brit. Mus., 1858, p. 88; Cope, Check List Batr. Rept. N. Amer., 1875, p. 39.

*Scotophis quadrivittatus* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 80.

*Elaphis quadrivittatus* Dum. Bibr., Erp. Gen., VII, 1854, p. 265; Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 153.

North Carolina to Florida, inclusive.

An instructive series of the young of this species was sent to the National Museum by William Wittfield, from Georgiana, Brevard County, Fla. They number nineteen specimens, and show how a longitudinally banded snake is developed from a spotted one. The specimens may be divided into three lots; the first including Nos. 13650, 13652, 13668, 13669, 13678, 13689, 13696, and 13706. These are the

smaller specimens, the smallest measuring 325 millimeters, and the largest 380 millimeters. The dorsal region is marked with brown spots on a light ground, and there is a series of smaller spots alternating with them on each side, with a trace of a second series of spots alternating with the last, on the ends of the gastrosteges. The dorsal spots have concave anterior and posterior borders, so that the angles of one spot approximate those of the adjacent ones. There are forty-two spots between the nape and vent. The angles of the nuchal spot are produced so as to form short bands, the anterior reaching to near the parietal scuta. There is a narrow brown postocular band, and a narrow one across the front on the posterior part of the prefrontal plates. The lateral spots of the body are elongate in front, the first forming a longitudinal line on the side of the neck. The gastrosteges are spotted at the ends, and the middle portions are clouded in some of the specimens.

In this stage these specimens are closely similar to the *C. spiloides*, except that the spots in the latter species are less numerous, ranging from thirty to thirty-five on the body. They can not be distinguished by the increased number of keeled rows of scales, as the keels are less evident in the young than in the adult.

The second set of specimens measured from 460 to 580 millimeters, and embraces Nos. 13646, 13657, 13681, 13703. Here the lateral angles of the dorsal spots are connected by a faint longitudinal stripe, thus forming the superior pair of stripes of the adult; and the lateral spots show a trace of a similar connection on the anterior part of the body. The marks on the head are present as in the smaller specimens, or they are broken into spots, or are nearly absent. The clouded marks of the belly are present or absent.

The third set varies from 580 to 620, and includes Nos. 13656, 13670, 13686, 13691. Here the lateral stripe is fairly distinct, and the head and belly are immaculate. Traces of the dorsal and lateral spots may be distinctly seen.

Associated with these specimens from the same locality is a young *C. guttatus* of 550 millimeters length. It displays all the characters of the adult, and does not vary in the direction of the *C. spiloides*, as do the young of the present species.

#### *Coluber spiloides* Dnm. Bibr.

Exp. Général VII, 1854, p. 269; Günth., Cat. Colubr. Snakes, Brit. Mus., 1858, 901.  
*Coluber obsoletus confinis* Cope, Check List Batr. Rept. N. Amer., 1875, p. 39.  
*Coluber obsoletus spiloides* Cope, Proc. U. S. Nat. Mus., 1888, p. 387.

Austroriparian region and Texas.

#### *Coluber obsoletus* Say.

In Long's Expedition Rocky Mts., I, 1823, p. 140; Harlan, Journ. Acad. Phila., v, 1827, p. 347; Cope, Check List Batr. Rept. N. Amer., 1875, p. 39.  
*Scotaphis obsoletus* Kennicott, Proc. Acad. Phila., 1860, p. 330.  
*Elaphtis obsoletus* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 151.

*Coluber allegheniensis* Holbrook, N. Amer. Herp., I, 1836, 111, Pl. xx; *ibid.*, 2d ed., III, 1842, p. 85, Pl. XIX.

*Scotophis allegheniensis* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 73.

*Elaphis allegheniensis* Allen, Proc. Bost. Soc. Nat. Hist., XII, 1868, p. 181; Jan. Icon. Gen. Ofid., II, 24 il.

*Elaphis holbrookii* Dum. Bibr., Erp. Gen., VII, 1854, p. 272.

*Scotophis lindheimeri* Bd. and Gird., Cat. Serpt. 1853, p. 74.

Two plates in the first row of temporals; eight superior labial plates. Parietal plate longer than or equal to length of muzzle from front of frontal plate. Scales generally in twenty-seven rows, sometimes rows keeled; tail long, scutella not exceeding 92; gastrosteges from about 230 to 245.

Black or brown above with or without darker subquadrate spots; head not banded; belly very darkly clouded.

This somewhat variable species is represented by two subspecific forms, one of which shows affinity to the *C. quadrivittatus*. They differ as follows;

Spots when visible on the very dark ground, distinct; a row of obscure spots on each side of them ..... *C. o. obsoletus*

Ground light brown above, marked by square dark brown spots, which are connected at the angles, forming a longitudinal stripe; no lateral spots, but a broad dark stripe four to six scales wide ..... *C. o. lemniscatus*

This species ranges throughout the entire Austroriparian region from the Rio Grande; and the eastern, excepting only the Hudsonian district. The form *C. o. lemniscatus* is restricted to the Gulf States, but the *C. o. obsoletus* extends as far north as Mount Tom, Massachusetts, on the Connecticut River, according to J. A. Allen. Dr. Holbrook records it from the highlands of the Hudson River, New York. Prof. Verrill does not enumerate it among the species taken near Norway, Maine.

This species is not rare in the Middle States. It is, like other members of the genus, of very inoffensive habits, and is useful in reducing the number of the small mammalia. It is much less active than the *Bascanium constrictor*, which it resembles in nothing but color. It is known as the Mountain Blacksnake, or Pilot Snake.

#### *Coluber obsoletus obsoletus* Say.

Cope, Check List Batr. Rept. N. Amer., 1875, p. 39.

*Coluber obsoletus* Say, Harlan, Cope, I. c., *Scotophis obsoletus* Kenn. *Coluber allegheniensis* Holbrook, I. c. *Scotophis allegheniensis* Bd. and Gird., I. c. *Elaphis allegheniensis* Allen, I. c.

*Elaphis holbrookii* Dum. Bibr., I. c.

*Scotophis lindheimeri* Bd. and Gird., I. c.

Eastern region exclusive of the Hudsonian district; Austroriparian region exclusive of Floridan district.

#### *Coluber obsoletus lemniscatus* Cope.

Proc. U. S. Nat. Mus., 1888, p. 386.

Georgia, Alabama.



*Coluber lætus* Bd. and Gird.

*Scotophis lætus* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 77.

Fort Smith, Arkansas (one specimen).

*Coluber emoryi* Bd. and Gird.

Cope, Check List N. Amer. Rept. Batr., 1875, p. 39.

*Scotophis emoryi* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 157; Report U. S. Mex. Bound. Surv., II, 1859, Pl. II, p. 19, Pl. XII.

*Scotophis calligaster* Kenn., Proc. Acad. Phila., 1859, p. 99.

*Coluber rhinomegas* Cope, Proc. Acad. Phila., 1860, p. 255.

This is a southwestern species of the eastern region, not having been yet found east of the Mississippi River nor north of Kansas. Its range extends at least as far south on the Mexican Plateau as the city of Chihuahua, where it has been found abundantly by Edward Wilkinson.

*Coluber bairdii* Yarrow.

*Coluber bairdii* Yarrow, Bull. U. S. Nat. Mus., No. 17, 1890, p. 41.

Fort Davis, northwestern Texas (one specimen).

**SPILOTES** Wagler.

Naturl. Syst. d. Amphibien, 1830, p. 179; Duméril et Bibron, Erp. Gen., VII, 1854, p. 248;

Günther, Cat. Coluber. Snakes Brit. Mus., 1858, p. 96; Cope, Bull. U. S. Nat.

Mus., 32, 1887, p. 56. *Georgia* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 92.

*Composoma* Dum. et Bibr., Erpet. Gen., VII, 1854, p. 290.

Teeth of equal lengths. Head plates normal; two nasals, one loreal and one preocular. Scales bifossate. Anal plate entire; subcaudal scuta divided. Pupil round.

This genus embraces the largest ground snakes of the Neotropical realm, together with a number of species of smaller size of the Palearctic. It differs from *Coluber* in its entire anal plate, resembling in this respect *Pityophis*, *Epiglottophis*, and *Rhinechis*. It approaches the last named most nearly in characters, but the rostral shield has not the production anteriorly and posteriorly seen in that genus.

The Asiatic species have a compressed form of the body which is not seen in the American forms. Some of the latter have a roof-shaped body with subtriangular section (*S. paucilostomus*), while in others (*S. corais*) the body is subcylindric. The scales assume a slightly transverse direction in some of the American species. But one species is found in the United States, and this is a Neotropical species which ranges from Brazil through Mexico and the Gulf States to the Atlantic coast.

*Spilotes corais* Cuv.

Dum. et Bibron, Erp. Gen., VII, 1854, p. 223; Günther, Cat. Brit. Mus., 1858, p. 98; Cope, Bull. U. S. Nat. Mus., 32, 1887, p. 72; Jan, Icon. Gen. Ofid., III, 48; IV, Fig. 6; V, Fig. 1.

*Coluber corais* Cuvier, Mus. Paris; Schlegel, Ess. S. la. Phys. Serpens, 1842, I, p. 145, and II, p. 139, Pl. V, Figs. 9, 10.

Head moderately distinct, oval. Body elongate, subcylindric; tail one-sixth to nearly one-eighth the total length. Rostral plate moderately prominent, broader than high, visible from above, but not dividing the internasals. Internasals much smaller than prefrontals. Frontal as broad as long; superciliaries posteriorly wider than frontal. Parietals large, longer than wide. Postnasal higher than prenasal; loreal rather small, longer than high. Oculars 1-2, the anterior widely separated above from frontal. Temporals 2-2, all long and narrow, those of the second row coinciding in anteroposterior extent with the last superior labial. Superior labials eight, the fourth and fifth bounding the orbit; the sixth triangular, the apex not reaching the postocular. Seventh higher, but not longer than the eighth. Inferior labials eight, fifth largest. Geni-als short, anterior pair the longer.

Scales smooth, rather wide, in seventeen rows.

Color varying from light brown to black, the tints when not uniform covering large parts of the body.

Size large, reaching a length of eight feet, with robust proportions.

There are three color varieties of this species which pass into each other, but which have especial geographic ranges. They are as follows:

Color light brown, with a black oblique stripe on each side of the neck... *S. c. corais*.

Color like *S. c. corais* anteriorly, but more or less of the posterior part of the body with tail, black..... *S. c. melanurus*.

Color black, the anterior gastrosteges with dark red bases, and the superior labials generally with dark red borders..... *S. c. couperi*.

The *S. c. corais* inhabits South America; the *S. c. melanurus* Central America and Mexico, and the *S. c. couperi* the Gulf States of North America.

#### *Spilotes corais couperi* Holbrook.

*Coluber couperi* Holbrook, N. Amer. Herpetol., III, 1842, p. 75; Pl. xvi.

*Georgia couperi* Bd. and Gird., Cat. N. Amer. Serpt., 1853, p. 92.

*Spilotes couperi* Cope, Proc. Acad. Phila., 1860, p. 564; Check List Batr. Rept. N. Amer., 1875, 33; Garman, Mem. Mus. Comp. Zool. Camb., VIII, 1883, p. 149.

*Georgia obsoleta* Bd. and Gird., Cat. Serpt. N. Amer., 1853, 153 (not *Coluber obsoletus* Say).

*Spilotes erebennus* Cope, Proc. Acad. Phila., 1860, p. 564; Check List l. c., p. 39.

Some of the specimens from the coast region of Georgia have only seven superior labials, while others have the usual number, eight. I do not find it to be a constant character, and so can not separate the *Coluber couperi* of Holbrook from his *C. obsoletus* ("Say," *S. erebennus* Cope). The half-grown specimen from eastern Georgia in the National collection is brown.

#### **RHINECHIS** Michaelles.

In Wagler Icones et Descript. Amphib. 1833 Pl. 25. Bonaparte, Fauna Italica 1838 Pl. 70; Duméril et Bibron, Erp. Generale, 1854, VII, p. 227; Cope, Bull. U. S. Nat. Mus., 1887, No. 32, p. 56.

Arizona Kennicott, U. S. and Mex. Bound. Surv.; II, 1859, Reptiles, p. 18.

Head moderately distinct, muzzle depressed, projecting. Tail rather short. Teeth equal. Cephalic plates normal; the rostral curved and

deeply separating the elongate internasals. Pupil round. Scales smooth, bifossate. Anal and subcaudal scuta, entire.

The production and recurvature of the rostral plate and entire anal plate distinguish this genus from *Coluber*, which it resembles. It was at one time thought to be allied to *Pityophis* in view of the presence of the two characters in question, but the absence of the epiglottis and undivided prefrontals show that it is distinct. There are several minor characters, not generic, which show that its affinities are not with the species of *Pityophis*. Such are the peculiar form of the inferior labial, prenasal, and loreal plates, and the very fine bristle-like spicules of the hemipenis, in the American species at least.

Two species are known which differ as follows:

Scales in from twenty-seven to thirty-one rows; internasal plates decurved in front; loreal elongate; temporals, 2-4; inferior labials 13-14, the anterior narrow, seventh largest. Tail less than one-sixth the length. Brownish gray with numerous transverse brown dorsal spots, with alternating lateral spots. . . . *R. elegans*.

#### *Rhinechis elegans* Kenn.

Cope, Proc. Amer. Philos. Soc., 1885, p. 234; *Arizona elegans* Kennicott, U. S. Mex-Bound. Surv., II, 1859, Reptiles, p. 18; *Pityophis elegans* Cope, Check List Batr. Rept. N. Amer., 1875, p. 39.

This species is subject to some variations. Thus in No. 4266 there is a small inferior preocular. In No. 14176 there are only twenty-seven rows of scales, and there is a row of three temporals between the usual 2-4 scaled rows.

This species is restricted in its range to the Sonoran region. The most southern locality yet known is near the city of Chihuahua. The most northern is north of the Cimarron River, probably in New Mexico.

M. Boëourt objects to my placing this species in the genus *Rhinechis*, as he says that the *R. scalaris* has the anal plate divided. It is true that Duméril and Bibron state that this is the case, but on examining four specimens from the Bonaparte Collection in the Museum of the Philadelphia Academy of Natural Sciences I find that the anal plate is entire.

#### *PITYOPHIS* Holbrook.

North American Herpetology IV, 1842, p. 7, Bd. and Gird., Cat. Rept. N. Amer., Pt. I Serpents, 1853, p. 64; Duméril, Prodrome des Erp. Gen., VII, 1854, p. 252; Günther Cat. Snakes, Brit. Mus., 1858; p. 85. Cope, Bull. U. S. Nat. Mus., No. 32, 1887, p. 56; *Churchillia* Bd. and Gird., Reptiles in Stansbury's Expl. Gt. Salt Lake, 1852, p. 350.

Teeth of equal lengths. A vertical laminiform epiglottis. Cephalic scuta normal except that each prefrontal is longitudinally divided into two, producing four prefrontals. Rostral plate more or less prominent, and its superior angle produced backwards. Scales more or less keeled, and with double apical pits. Anal scutum entire; subcaudals in two series. Pupil round,

This genus of Colubrine snakes includes rather large and robust species. They are restricted exclusively to the Nearctic Realm and the Lower Californian district of the Neotropical. They are entirely terrestrial in their habits, preferring dry and even sandy regions to any other. They are of a harmless disposition as a general rule, but the *P. sayi bellona* defends itself vigorously when attacked. The peculiar epiglottis, first observed and described by Dr. C. A. White of Washington, aids these snakes in emitting an unusually loud hiss on the expiration of the air contained in their voluminous lung. This sound, although it cannot be called a voice, is sufficiently loud to be alarming, and serves no doubt as a defense.

The question as to the number of species included in this genus is a difficult one to decide. The *P. melanoleucus* may be always distinguished by color characters from the forms found west of the Mississippi River. From some of these it also differs in the shape of the head and muzzle, but the most eastern of the western forms, *P. sayi sayi*, resembles it in these respects. The Lower Californian form may be distinguished from the *P. melanoleucus* by color characters, and by the shape of the head and muzzle, but between it and the *P. sayi* of the western Mississippi region there is a complete transition in most of the characters. The California form resembles that of Lower California in form, but differs in color, while the Arizona form is in every respect intermediate between the Pacific form (*P. catenifer*), and the *P. sayi* of the plains. These forms are tolerably constant and can be generally recognized. The form of the rostral plate is the most characteristic peculiarity, but, from the nature of the case, transitions occur. Under the circumstances I have adopted four species, of which the *P. sayi* has two subspecies, one of which, *P. s. bellona* is intermediate between its typical form and the *P. catenifer*; the latter differing, however, in the greater smoothness of the scales.

## SYNOPSIS OF SPECIES.

- Scales with stronger keels beginning on the fourth row; head short, elevated, rostral plate compressed, and narrowed above; no head stripes; dorsal spots few, 27-33 on body ..... *P. melanoleucus*.  
Scales first keeled on the sixth row; rostral plate narrowed above; head stripes present; spots numerous, 40-65 on body ..... *P. sayi*.  
Scales weakly keeled, first on tenth row; rostral little prominent, not narrowed above; head flat; head stripes present; spots numerous, 36-79 on body .....  
*P. catenifer*.  
Scales weakly keeled, beginning on tenth row; rostral plate not narrowed, and little prominent; head flat; spots few, 40-44 on body, anteriorly red; no head-stripes.  
*P. vertebralis*.

The head stripes consist of a band extending from the eye to the angle of the mouth, another from the eye to the upper lip below it, and another across the front of the frontal plate connecting the orbits. These stripes are present in the young of the species which lack them

at maturity. The increase in the number of spots is accomplished by the division of those on the posterior part of the body.

The number of the labial plates is apt to be unequal on the opposite sides. Thus in seventy-two specimens examined, fifteen have nine labials on one side and eight on the other. The *P. catenifer* displays the greatest irregularity in this respect, six out of sixteen specimens having labials 8-9.

***Pityophis melanoleucus* Daudin.**

Holbrook, N. Amer. Herpetology IV, 1842, p. 7, Pl. 1; Bd. and Gird., N. Amer. Serp., 1853, p. 65; Dum. et Bibron, Erp. Gen. VII, p. 233, 1854; Günther, Cat. Col. Serp. Brit. Mus., 1858; p. 86; Cope, Check List N. Amer. Batr. Rept. Bull. U. S. Nat. Mus. I, 1875, p. 39.

*Coluber melanoleucus* Daudin, Hist. Rept., VI, 1803, p. 409 (from Bartram); Harlan, Journ. Acad. Phila., 1827, p. 359.

Specimens from Florida have the dark colors rusty or rufus instead of deep brown or black, and the outlines of the spots are not so well defined.

This species ranges from New Jersey to Florida, preferring the sandy pine woods of the coastal plain. It is the largest snake of this region. It is of a very harmless disposition, and may be handled with impunity.

***Pityophis sayi* Schlegel.**

Bd. and Gird., Cat. Rept. N. Amer., Pt. I, Serpents, 1853, p. 151; Cope, Check List Bat. Rept. N. Amer., 1875, p. 39; *Coluber sayi* Schlegel, Ess. S. I. Physionomie des Serpents, 1837, p. 157, partim.

Head with the rostral plate more or less prominent forward and produced and narrowed upwards and posteriorly. Superior labial plates 8-8 to 9-9. Scales in from twenty-seven to thirty-three rows, keeled, except six rows on each side. Dorsal spots more numerous than in *P. melanoleucus* varying from fifty to sixty-five on the body, sometimes as few as forty. Two to three rows of spots on each side. Generally no subcaudal stripe. Head with three bands; one extending between the orbits, one from the orbit directly downwards to the labial border, and one from the orbit to the angle of the mouth. Temporal scales small, generally 3-3 to 4-4; rarely 2-2.

This species occupies the entire interior of the United States and the Mexican plateau to the valley of Mexico. Eastward it crosses the Mississippi River into the prairie country of Illinois. It is represented by two forms, which only differ in the form of the rostral plate. One of these (*P. s. bellona*) inhabits Arizona and New Mexico only, and is intermediate in character between the typical *P. s. sayi*, and the *P. catenifer*. These forms differ as follows:

Rostral plate compressed and produced upwards and backwards; often traces of a black subcaudal stripe.....	<i>P. s. sayi</i> .
Rostral plate less compressed, and less narrowed above; no traces of the black subcaudal stripe .....	<i>P. s. bellona</i>

*Pityophis sayi sayi* Schl.

Cope, Check List N. Amer. Batr. Rept. N. Amer., 1875, p. 39.

*Pityophis sayi* Bd. and Gird., Cat. N. Amer. Rept., Pt. I, Serpents, 1853, p. 151; *Coluber sayi* Schlegel, Ess. s. l. Physionomie des Serpents, 1837, p. 157; *Pityophis maclellanii* Bd. and Gird., Cat. 1853, p. 68; *Pityophis mexicanus* Dum. Bibr., Erp. Gen., VII, p. 236; 1854, Jan, Icon. Jan. Ofid., II, 22 ii, Fig. 1.

This subspecies ranges from western Canada to the central region of North America and Mexico to the valley of Mexico, inclusive. It is the common species of Texas, and even occurs in Sonora. It is a curious fact that this form has both the extreme northern and southern ranges, while the Arizonian form is so restricted.

*Pityophis sayi bellona* Bd. and Gird.

Cope, Check List N. Amer. Batr. Rept., 1875, p. 39. *Pityophis bellona* Bd. and Gird., Cat. Rept. N. Amer., Pl. I, Serp., 1853, p. 66; *Churchillia bellona* Bd. and Gird., Reptiles of Stansbury's Report Expl. Great Salt Lake, 1852, p. 350; *Pityophis melanoleucus*, Jan, Icon. Gen. Ofid., II, 22 i, Fig. 2.

Of sixteen specimens examined, twelve have 8-8 superior labials, two have 8-9; and two have 9-9. Four have twenty-nine rows of scales, nine have thirty-one and two have thirty-three. Six have between forty and fifty dorsal spots on the body; eight have between fifty and sixty; and two have sixty to sixty-three. About two-thirds have the centers of the dorsal spots paler than the borders, and the remainder have the spots black throughout. The only constant character of this subspecies as compared with *P. s. sayi* is the form of the rostral plate, but No. 8401 is intermediate between the two in this respect. Some specimens from Oregon are intermediate between it and *P. catenifer*.

The geographical range of this subspecies is the Great Basin from Oregon south to the basin of the Colorado, and Arizona.

The typical specimen of the *Churchillia bellona* Bd. and Gird. can not now be found. It is, however, from the valley of the Rio Grande, which is principally occupied by the *P. sayi sayi*. The second specimen enumerated in Baird and Girard's catalogue under the *P. bellona* is from western Texas, between San Antonio and El Paso, and hence from the same region as the type. This belongs to the *P. sayi sayi*, as determined by the examination of the specimen in the U. S. National Museum. However, Baird's figure of the head of the *P. bellona* in the Vol. x of the Report of the U. S. Surveys for the Pac. R. R., Pl. XXIX, Fig. 46, represents this subspecies.

*Pityophis catenifer* Blainv.

Bd. and Gird., Cat. Rept. N. Amer., Pt. I, Serpents, 1853, p. 69; Günther, Cat. Colubr. Snakes Brit. Mus., 1858, p. 87; Cope, Check List N. Amer. Batr. Rept., 1875, p. 39; *Coluber catenifer* Blainville, Nouv. Ann. Mus. Hist. Nat. Paris, IV, 1835, Pl. XXVI, Figs. 2, 2a, 2b; *Pityophis annectens* Bd. and Gird., Cat. Serp., 1853, p. 72; *Pityophis wilkesii* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 71; *Pityophis heermanni* Hallowell, Proc. Acad. Phila., 1853, p. 236; *Pityophis vertebralis* Hallowell, U. S. Pac. R. R. Surv. Rept., x, 1859; Williamson's Report, p. 17.

Of seventeen specimens examined, seven have the superior labials 8-9; eight have 8-8; and two have 9-9. Four have twenty-nine rows of scales; ten have thirty-one rows; one has thirty-three; and one has thirty-five (No. 2243). The number of spots on the body is very variable. One has thirty-six dorsal spots (No. 1546); one has forty-six (No. 1532); seven have between fifty and sixty; four have between sixty and seventy; and four have over seventy, the highest being seventy-nine (No. 1816). The specimen (No. 5741) on which the *P. wilkesii* Bd. and Gird., was founded is abnormal in the nondivision of the prefrontal scuta; the only example I have observed in the genus.

The range of this species is coterminous with the Pacific region, extending from San Diego on the south to Puget's Sound on the north. It is found in the Mohave Desert, and at Pymont, Nevada (8139). Northward it extends to eastern Oregon and to Walla Walla, Washington.

***Pityophis vertebralis* Blv.**

Dumeril et Bibron, *Erp. Gen.*, vii, 1854, p. 238; Cope, *Check List Batr. Rept. N. Amer.*, 1875, p. 39; *Bull. U. S. Nat. Mus.*, 32, 1887, p. 72.

*Coluber vertebralis* De Blv., *Nouv. Ann. Mus. Nat. Hist.*, Paris, iii, 1834, p. 61, Pl. xxvii, Figs. 2, 2a, 2b; Bd. and Gird., *Cat. Serpt. N. Amer.*, 1853, p. 152.

*Pityophis hamatois* Cope, *Proc. Acad. Phila.*, 1860, p. 342.

*Pityophis melanoleucus* var. *vertebralis* Blv., *Jan, Icon. Gen. Ofid.*, ii, 22, i, fig. 3.

Peninsula of lower California.

**HETERODON Beauvais.**

In Latreille's *Hist. Nat. des Reptiles*, iv, 1799, p. 32.

Dumeril et Bibron, *Erpetologie Generale*, vii, 1854, p. 766; Bd. and Gird., *Cat. Serpt. N. Amer.* 1853, p. 51; Günther, *Cat. Colubr. Serpt. Brit. Mus.*, 1858, p. 82; Cope, *Bull. U. S. Nat. Mus.*, 32, 1887, p. 54.

Dentition diacranterian. Caudal scutella divided; anal plate double. Rostral plate recurved, with transverse upturned edge and flat antero-inferior face. The nine cephalic plates, a loreal, two nasals and ocular plates, present. Scales keeled. Form robust. Pupil round.

The few species of this genus which are known agree also in having a series of scales separating the eye from the superior labial plates, and in having an azygos plate behind the rostral. The posterosuperior aspect of the rostral plate has a keel on the middle line, and there are from three to five, generally four, scales in the first temporal row. The tail is short. The anterior ribs are capable of extension so as to flatten that part of the body, as is done by the cobras of the genus *Naja*, but the expansion is not so wide, and it has greater longitudinal extent. The postgenital plates are reduced to a very small size, and are separated from each other by small scales.

The species of this genus ranges throughout North America excepting the Pacific region. They do not extend far into the Sonoran, and are absent from the Lower Californian and the Mexican regions. They have no representatives in equatorial America or the West Indies, but a

genus *Lystrophis* Cope\* is found in subtropical and temperate South America, which only differs from *Heterodon* in possessing smooth scales. A genus occurs in Madagascar which agrees with *Lystrophis*, but differs in having an entire anal shield (*Lioheterodon* Dum. Bibr.).

The species of *Heterodon* have some peculiar habits which indicate greater intelligence than most other snakes possess. They throw themselves into remarkable contortions when alarmed, and expand their anterior ribs, inflate their lung, and open the mouth widely. They do not attempt to bite from the ground, but the long posterior maxillary tooth may be used with considerable effect if the snake is carelessly handled. The trowel-shaped rostral plate enables them to excavate sand with ease, and in such soil they are usually most abundant.

I. No accessory scales about the azygos plate.

Scales in twenty-five rows; rostral plate less developed; larger... *H. platyrhinus*.

II. Accessory scales about the azygos scute.

Scales in twenty-five rows; stouter, smaller; an inferior nasal plate; one row of lateral spots; belly white in adults ..... *H. simus*.

Scales in twenty-three rows; smaller, more slender; no inferior nasal scute; two rows of lateral spots; belly more or less black..... *H. nasicus*.

The *H. platyrhinus* ranges throughout the Eastern and Austroriparian regions, and the *H. simus* inhabits the Austroriparian only. The *H. nasicus* is divided into two subspecies, one of which extends over the Central and the other over the Sonorian regions.

***Heterodon platyrhinus* Latreille.**

Reptiles, IV, 1800, p. 32, Figs. 1, 2, 3; Holbrook, N. Amer. Herp., II, 1828, p. 97, Pl. XXI; second ed., IV, 1842, p. 67, Pl. XVII; Dum. Bibr. Erp. Gen., VII, 1854, p. 766; Bd. and Gird., Cat. Serp. N. Am., 1853, p. 51; Cope, Check List Batr. Rept. N. Amer., 1875, p. 43; Jan, Icon. Gen. Ofid., III, 48 iii Fig. 2.

*Coluber heterodon* Daudin, Hist. Nat. Rept., VII, 1799, p. 153, Pl. 6, Fig 28; Say, Am., Journ. Sci. Arts, I, 1818, p. 261; Harlan, Journ. Acad. Phila., 1827, p. 357.

*Coluber cacodemon* Shaw, Gen. Zool., III, 1802, p. 377, Pl. 102.

*Scytale niger* Daudin, Hist. Nat. Rept., V, 1803, p. 342; Harlan, Journ. Acad. Phila., 1827, V, p. 367.

*Pelias niger* Merrem, Tentamen, 1820, p. 149.

*Heterodon niger* Troost, Am. Lyc. Nat. Hist. N. York, III, p. 186; Holbrook, N. Amer. Herp., IV, 1842, p. 60, Pl. XVI; Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 55; Dum. et Bibr., Erp. Gen., VII, p. 769.

*Heterodon cognatus* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 54.

*Heterodon atmodes* Bd. and Gird., l. c., p. 57.

Eastern region excepting Hudsonian district; Austroriparian region.

***Heterodon simus* Linn.**

Holbrook, N. Amer. Herp., IV, 1842, p. 57, Pl. XV; Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 59.

*Heterodon simus simus* Cope, Check List N. Amer. Batr. Rept., 1875, p. 43.

\* Bull. U. S. Nat. Mus., No. 32, 1887, p. 54.



*Coluber simus* Linn., Syst. Nat. Ed., XIII, 1766, p. 216; Gmel. Linn. Syst. Nat. Ed., XIII III, 1788, p. 1086.

*Heterodon platyrhinus* Schleg., Ess. Phys. Serp., 1837, p. 97, Pl. III, Figs. 20, 22; Dumet Bibr., Erp. Gen., VII, 1854, p. 768-772.

### Austroriparian region.

#### *Heterodon nasicus* Bd. and Gird.

Cat. Rept. N. Amer., Pl. I, Serpents, 1853, p. 61; *Heterodon simus nasicus* Cope, Check List Batr. Rept. N. Amer., 1875, p. 43.

Frontal and parietal scuta usually wider than long, the parietals often shorter than the frontal. Head short; rostral plate very large and strongly recurved. No inferior nasal plate cut off from the postnasal. Two or more loreals. Superior labials eight, all much higher than long. First row of temporals generally four. From three to twenty-four accessory scales beside and behind the azygos plate. Scales in twenty-three rows, all keeled except the first three on each side. Proportions of body more slender than in *H. simus*.

Color light yellowish gray above, with a median dorsal series of rather closely placed brown spots, and with two alternating series of brown spots on each side. Three brown, short, longitudinal nuchal brown bands, and a brown band from each eye posteriorly. Belly either entirely black or tessellated with black and white.

This is the western representative of the *H. simus*, to which it is nearly allied. It can be always distinguished, however, especially in its typical subspecies, by the characters given. A single specimen out of the many in the U. S. National Museum (No. 4961), from Texas, displays an inferior nasal plate.

Two forms of the *H. nasicus* inhabit different regions and may be regarded as subspecies.

Scales accessory to azygos plate, two or three; loreal small or wanting; belly black and white spotted.....*H. n. kennerlyi*.

Scales accessory to azygos plate from eight to twenty-four; loreals generally two; belly nearly entirely black.....*H. n. nasicus*.

In the *H. n. kennerlyi* in three out of six specimens the parietal scuta are shorter than the frontal. In sixteen of the *H. n. nasicus*, ten specimens have the parietals shorter than the frontal. In the small number of accessory scales the *H. n. kennerlyi* approaches the *H. simus* more more nearly does the *H. n. nasicus*. The same affinity is indicated by the smaller amount of black on the belly. It represents the genus in the Sonoran region, while the *H. n. nasicus* occupies the central.

#### *Heterodon nasicus kennerlyi* Kennicott.

*Heterodon kennerlyi* Kennicott, Proc. Acad. Phila. 1860, p. 336. *Heterodon simus kennerlyi* Coues & Yarrow, Herp. Dak. & Mont., Bull. U. S. Geol. Surv. Terra., 1878, IV, p. 271; Jan, Icon. Gen. Ofid., Livr. 10, Pl. v, Fig. 2.

Western Texas and Southern Arizona.

**Heterodon nasicus nasicus** Bd. and Gird.

*Heterodon nasicus* Bd. and Gird., Cat., Pt. I, Serpents, 1853, p. 61.

*Heterodon simus nasicus* Cope, Check List Batr. Rept. N. Amer., 1875, p. 43.

Jan, Icon. Gen. Ofid., Livr 10, Pl. v, Fig. 1.

Central and Sonoran regions.

**EUTÆNIA** Bd. and Gird.

Cat. Serp. N. Amer., 1853, p. 24; Cope, Proc. Amer. Philos. Soc., 1886, p. 475.

*Thamnophis* Fitz. Syst. Rept., 1843, p. 26 (*nomen nudum*).

*Prymniodon* Cope, Proc. Acad. Phila., 1860, p. 558.

The genus *Eutænia* presents especial attractions to the student who desires an illustration of the phenomena of variation and constancy in the physical characters of animals. In few genera do we find so well illustrated the persistence of specific characters exhibited side by side with variations of the same. We have here, therefore, examples of the appearance or disappearance as the case may be, of characters, in connection with or without apparent connection with, the environment.

This genus was established by Baird and Girard in the Catalogue of Serpents of North America, published in 1853, on species which had been previously referred to the genus *Natrix* (*Tropidonotus*). To the three species previously known, these authors added four, and nine names were proposed for what are in my estimation either subspecies or individuals of the seven species actually distinguished; in the year 1860 Kennicott added five species; at various dates between 1860 and 1885 the present writer added nine species and referred to the genus a species long previously described by Wiegmann; in 1890 Brown added a species; and a species is described for the first time in the present review. The total number of species is then twenty-four.

The characters of the genus are as follows:

Subfamily *Natricinæ*. Cephalic plates normal; two nasals, one loreal. plate Eyer resting on superior labials. Scales keeled, without pits. Anal plate entire; subcaudals divided.

The maxillary teeth are rather abruptly longer at the posterior extremity of the maxillary bone than elsewhere, as in the genus *Natrix*, with two exceptions. These are the species *E. multimaculata* Cope and *E. melanogaster* Wiegman. I have on this account distinguished these species as constituting another genus which I called *Atomarchus*, the character distinguishing it from *Eutænia* being the equality in length of the maxillary teeth. As the excess in length of the posterior teeth is small in some of the species of the latter, I have not for the present retained this genus, although it may be found to be advisable to do so hereafter. The two species mentioned are more aquatic in their habits than the *Eutæniæ* proper.

*Eutæniæ* are the most abundant snakes in North America and Mexico. Where all other species are absent, either through hostility of the climate or of enemies, individuals of this genus remain. This persist-

ence may be ascribed to several causes. One of these is their great fecundity. Prof. Baird mentions a specimen of *E. sirtalis* which produced eighty young at a birth. Another cause is their readiness to seek concealment in water, so that they most readily escape observation.

Several of the species are pugnacious in their disposition. Such is the case with the two which have the widest distribution and greatest abundance of individuals, the *E. sirtalis* L. and *E. elegans* Bd. and Gird. Their bite, it is needless to remark, is perfectly harmless. Some of the species possess great elegance of form, as those of the *E. saurita* group. Others have much brilliancy of color, as the metallic green of some forms of the *E. proxima* and *E. sackenii*, and the red and black of the *E. sirtalis concinna*.

The species differ as follows:

I. Second and usually the first row of scales keeled; lateral stripe on third and fourth rows. Orbit bounded below by two or more labials.

1. Temporal scales 1-2.

\* Tail equal or exceeding one-third total length; first row of scales much longer than deep, strongly keeled; scales in 19 rows.

Superior labials eight, longer than high; very slender; color metallic oliv.

*E. sackenii*.

Superior labials seven, longer than high; very slender; color brown.

*E. saurita*.

\*\* Tail less than a third and more than a fourth the total length; superior labials eight.

Head flat; superior labials longer than high; scales in nineteen rows; inferior row keeled, longer than deep..... *E. proxima*.

Head elevated, superior labials higher than long; scales in 21 rows, those of inferior row as deep as long..... *E. megalops*.

\*\*\* Tail more than one-fourth, and not less than one-fifth the total length; scales in 21 rows, the inferior row as deep as long, and weakly or not keeled.

Superior labials seven; tail less than four and five tenth times in total length..... *E. radix*.

Superior labials eight; tail more than four and five tenth times in total length.

*E. macrostemma*.

2. Temporal scales 1-1.

Tail between one-fifth and one-fourth the total length; superior labials seven; head little distinct; yellow black bordered lateral stripe on second, third, and fourth rows of scales..... *E. butleri*.

Tail between one-fourth and one-third the total length; superior labials eight; head quite distinct; lateral line faint, on third and fourth rows.

*E. rutiloris*.

II. Second row of scales keeled; the first keeled or smooth. Orbit above two labials. Lateral stripe, when present, on second and third rows of scales.

1. Temporal scales, 1-2.

\* Scales in twenty-one (3) rows; superior labials, eight.

Two preoculars; superior temporals small; first row of scales keeled; black, stripes indistinct; head short, frontal wide..... *E. bicincta*.

One preocular; superior temporals small; head short, frontal wider, not touching preocular, posterior labials higher than long; tail three and one-third to four and two-third times in length..... *E. elegans*.

One preocular; a large superior temporal bounding occipital; frontal narrow, touching preoculars; head long, labials all longer than high; tail three and one-fourth in length..... *E. angustirostris*.

## II—Continued.

## 1. Temporal scales, 1-2—Continued.

\* \* Scales in seventeen rows; superior labials eight.

Frontal narrow; head very distinct; no dorsal stripe nor lateral spots except anteriorly.....*E. chrysocephala*.

\* \* \* Scales in nineteen rows; superior labials eight.

Form slender; head very distinct; eye large, frontal plate narrow; belly, dorsal and indistinct white lateral stripe; sides black spotted; a large nuchal black spot.....*E. cyrtopsis*.Form robust, head distinct, frontal plate wide; large black nuchal spots; labials and belly uniform yellow; dorsal and lateral stripes very distinct, separated by uniform brown.....*E. aurata*.Form robust, head little distinct; frontal wide; lateral stripe indistinct, a yellow dorsal stripe; no nuchal spots.....*E. infernalis*.Form stout, head little distinct, eye moderate; labials dark bordered; stripes wanting; one row of large reddish brown bordered dorsal spots; small.  
*E. phenax*.

Labials dark bordered; no stripes; six rows of small black spots.

*E. sumichrasti*.

\* \* \* \* Scales in nineteen (17) rows; superior labials seven.

a Two preoculars (sometimes united).

Head scarcely distinct; two or three rows of spots on each side.

*E. leptcephala*.

aa One preocular.

Head scarcely distinct; postgenials short; stripes indistinct, connected by a single series of brown crossbars on each side.....*E. scalaris*.Head little distinct; form slender; stripes very distinct; yellow, separated by black or brown; the scales with yellow keels; lateral band black bordered below.....*E. pulchrilatus*.Form stout, head distinct; postgenials larger than pregenials; two rows of spots on each side, sometimes connected longitudinally above or below; stripes pale.....*E. sirtalis*.

## 2. Temporal scales 3-2.

\* Scales in twenty-one rows; superior labials eight.

Frontal wide, reaching preoculars; second row of scales as wide as first; stripes distinct; separated by two rows of spots; a broad black band below lateral stripe; labials brown bordered.....*E. nigrilatus*.

## III. Second row of scales keeled; orbit bounded below by a single labial.

\* Scales in twenty-one rows; superior labials eight.

## 1. Temporals 1-3.

Oculars 3-3; labials longer than high; loreal longer than high; muzzle narrow; seven rows of spots; no stripes.....*E. multimaculata*.

## IV. Second row of scales smooth, like the first; others with keels. Orbit bounded by two superior labials.

\* Scales in twenty-one rows; superior labials eight.

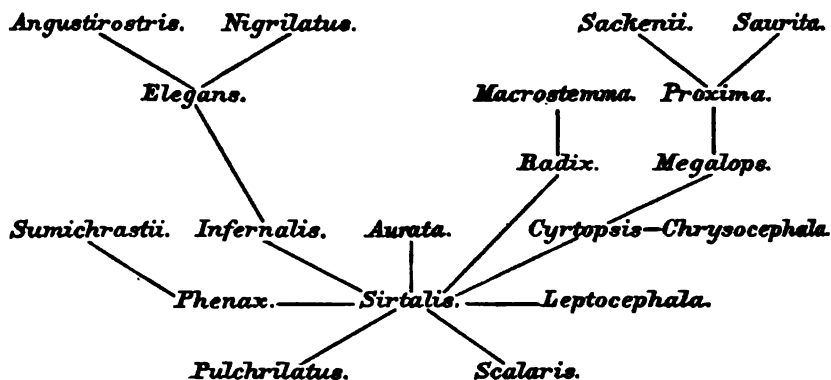
Two preoculars; temporals 1-4; superior labials larger than high; rostral plate transverse and cap-shaped. Light brown with small rufous spots anteriorly.....*E. rufopunctata*.

\* \* Scales in nineteen rows; superior labials eight.

## 1. Temporals 1-2.

Oculars 2-3; loreal longer than high; head little distinct; dusky, stripes wanting or indistinct.....*E. melanogaster*.

The affinities of most of these species may be expressed in the following diagram:



The *E. sirtalis* presents the greatest number of points of contact with other species. It also inhabits the region of geologically the greatest age, or that region which has been a dry land area for the longest time. Although large portions of the West of North America were elevated at the close of the cretaceous period, and probably before the genus *Eutænia* was in existence, the ancestors of *Eutænia* may be safely believed to have inhabited the area which was land prior to the cretaceous, so that the descent of *Eutænia* was rendered possible in the Eastern rather than in the Western half of the continent. It is thus rendered probable that *Eutænia sirtalis* is nearly the ancestral form. This is also confirmed by the fact that it is a spotted species; since the unicolor species, as *E. saurita* have spotted young.

The geographical distribution of these species may be tabulated as follows, by regions:

Eastern (3).	Austroriparian (4).	Central (3).	Pacific (5).	Sonoran (6).	Mexican (11).*
<i>E. saurita.</i> <i>E. butleri.</i>	<i>E. saurita.</i> <i>E. sackenii.</i> <i>E. proxima.</i>	<i>E. radix.</i>  <i>E. elegans.</i>	<i>E. elegans.</i> <i>E. biscutata.</i>  <i>E. infernalis.</i>	<i>E. megalops.</i>   <i>E. cyrtopsia.</i>  <i>E. aurata.</i>	<i>E. proxima.</i>  <i>E. rutiloris.</i> <i>E. macrostoma.</i>  <i>E. angustirostris.</i> <i>E. cyrtopsia.</i> <i>E. chrysocephala.</i>  <i>E. phenax.</i> <i>E. sumichrastii.</i>
<i>E. sirtalis.</i>	<i>E. sirtalis.</i>	<i>E. sirtalis.</i>	<i>E. sirtalis.</i>  <i>E. leptocephala.</i>	<i>E. nigrilatus.</i> <i>E. rufopunctata.</i> <i>E. multimaculata.</i>	<i>E. scalaris.</i> <i>E. pulchrilatus.</i>  <i>E. melanogaster.</i>

\* Probably not a homogeneous district.

The above table gives but a very general view of the distribution of the species, since some of them are restricted to districts of the regions only, while a few species are known from so few examples that their range is unknown. Of the latter class are *E. butlerii*, *E. rutiloris*, *E. angustirostris*, and *E. nigrilatus*. The *E. sackenii* is restricted to Florida, and the *E. radix* to that part of the central region that lies east of the Rocky Mountains, entering the eastern region. The widely distributed species, as *E. sirtalis* and *E. elegans*, are represented in special districts by peculiar subspecies, which look very different from each other. The *E. proxima* has a range which does not coincide with any zoological district, inhabiting eastern Mexico, Texas, and the Mississippi Valley.

The following review is preparatory to the complete monograph included in my Reptilia of North America, which it is expected will form one of the bulletins of the U. S. National Museum. The material on which this is based is mostly contained in that Museum, and I have had access to it through the permission of Secretaries Baird and Langley.

The study of the several hundred specimens of species of this genus which are contained in the National Museum and my private collection shows that in most of the species the number of rows of scales and the number of the labial plates are quite constant. In only one species, the *E. leptocephala*, is the number of scale rows varied by the presence or absence of a single row on each side, and in none is the number of labial plates frequently variable. The position of the lateral stripe is, as stated by Baird and Girard, very constant. The relative length of the tail is constant within certain limits and in certain species. In some of the species it varies a good deal. The coloration varies within limits in each species, and often characterizes subspecies with considerable precision, transitional forms in some such cases being rare, and in others more frequent. The species of the Pacific coast present the greatest difficulties to the systematist. Here the eastern *E. sirtalis* comes into contact with the western *E. elegans*, and some intermediate forms occur. The *E. sirtalis parietalis* resembles very much the *E. elegans ordinoides*, and the *E. sirtalis sirtalis* resembles a good deal the *E. elegans lineolata*. The *E. infernalis* intervenes between the two. The *E. leptocephala* appears quite distinct from the southernmost coast forms, but it has melanistic phases which resemble a good deal melanistic forms of the *E. sirtalis*; e. g., *E. s. trilineata* and *E. s. pickeringii* of the northwest coast region of Washington.

The colors of the young afford some clue to the order of probable appearance of color marks in the adults. As already remarked by Baird and Girard, the spots are more distinct in the young than in adults, both as to isolation from each other and in distinctness of outline and color. When spots disappear and are replaced by a uniform tint, both lighter (*E. elegans vagrans*), and darker (*E. elegans lineolata* and *E.*

*sirtalis obscura*), the change first appears on the posterior part of the body. The tendency to form crossbars or spots appears first on the anterior part of the body. This is slightly developed in the *E. sirtalis semifasciata*, but extends throughout the greater part of the length in the *E. phenax*. In species in which the top of the head is pale, as *E. elegans vagrans*, it is dark or black in the young. This dark color is paled also in the *E. e. couchii*, and in the *E. e. marciana*, but leaves the posterior portion as a pair of large black nuchal spots.

In the following pages the characters of the subspecies and their range are considered.

***Eutænia sackenii* Kennicott.**

Proc. Acad. Phila., 1859, p. 98; Cope, Proc. U. S. Nat. Mus., 1888, p. 393. *Pyramionion chalcus*, Cope, Proc. Acad. Phila., 1860, p. 558.

Florida west to Pennsacola.

***Eutænia saurita* L.**

Bd. and Gird., Cat., 1853, p. 24; *Coluber saurita* Linn. Syst. Nat. 1, 1766, p. 385. *Leptophis sauritus* Holbrook, N. Amer. Herpetol., III, 1842, p. 21. *Tropidonotus sauritus* Dumet Bibr., Erp. Gen., VIII, 1854, p. 585. Schlegel Ess. s. Physion. Serp., I, p. 69; II, p. 586; Günther, Cat. Colubr., Snakes, Brit. Mus., 1858, p. 72; Jan., Icon. Gen. Ofid., II, 26; I, fig. 1; dorsal stripe too wide.

Eastern and Austroriparian regions except Texas.

***Eutænia proxima* Say.**

Bd. and Gird., Cat., 1853, p. 25. *Coluber proximus* Say, in Long's Exped. Rocky Mts., I, 1823, p. 187. *Eutænia faireyi* Bd. and Gird., Cat., 1853, p. 25.

The Mississippi Valley from Indiana and Illinois; Texas and Mexico below the plateau to Tehuantepec.

The individuals found in the Mississippi Valley from New Orleans northwards are mostly of a darker color than those from other regions, the spaces between the stripes being generally black. (*E. faireyi* B. & G.) This form accompanies the typical and lighter colored one in Louisiana and eastern Texas as far west as Dallas. Many transitions between the two occur. Specimens from Vera Cruz have a metallic refulgence. A pair of specimens from Fort Stockton, Tex., have the same character, and the dorsal stripe is indistinct, having no lateral black borders. The west Texas form generally has the dorsal stripe reddish.

***Eutænia megalops* Kennicott.**

Proc. Acad. Phila., 1860, p. 330; Cope, Proc. Amer. Philos. Soc., 1884, p. 173.

Sonoran region (southern New Mexico and Arizona and Chihuahua).

***Eutænia radix* Bd. and Gird.**

Cat. Serp. N. Amer., Pt. I, Serpents; Cope, Check List Batr. Rept. N. Am., 1875, 1853, p. 34. *Eutænia haydenii* Kennicott, Rept. U. S. Pac. R. R. Surv., suppl. to Vol. I (Vol. XII), 1859, p. 298.

*Eutænia radix twiningii* Coues and Henshaw.

*Eutænia radix melanotania* Cope, Proc. U. S. Nat. Mus., 1888, p. 400.

This is the species of the plains, and it is well distinguished from all others. It ranges from Dallas, in northern Texas, on the south, to Manitoba on the north, and from the base of the Rocky Mountains on the west to the eastern limit of the prairies in Indiana on the east. It varies in color somewhat, but not sufficiently to give ground for the adoption of subspecies. The fact that of the very many specimens which are preserved in museums, the type is the only one which has nineteen rows of scales, has given rise to the synonyms above enumerated. Southern specimens (*E. v. haydenii*) are more brightly colored and more distinctly spotted than northern ones; in fact some of the latter are nearly black; hence the name *E. v. twiningii*; but these agree with the type exactly, except in having twenty-one rows of scales. In the *E. v. melanotania* from Indiana there is an imperfect longitudinal stripe crossing the end of the gastrosteges; but it is much interrupted.

*Eutænia macrostemma* Kenn.

Proc. Acad. Phila., 1860, p. 331. *Eutania flavilabris* Cope, Proc. Acad. Phila., 1866, p. 306; *Eutania insigniarum* Cope, Proc. Amer. Philos. Soc., 1884, p. 172.

This is the representative of the *E. radix* in Mexico, but it always differs in having eight superior labials and a shorter tail. It has three forms. In one the longitudinal stripes and spots are obscure or wanting and the size is larger. This is the *E. insigniarum* Cope. In another, all the markings are very distinct, the lighter ones being a bright yellow; the size is smaller. This is the *E. flavilabris* Cope. It comes from various parts of Mexico. The type specimen of the species is intermediate between the two in color, and the size is like that of the *E. insigniarum*. It is from the valley of Mexico. Three specimens of the form *insigniarum* were sent to the zoölogical garden at Philadelphia, which are said to have been taken near Prescott, Ariz. One of them has an additional superior labial intercalated in front of the orbit.

*Eutænia butlerii* Cope.\*

Proc. U. S. Nat. Mus., 1888, p. 399.

Southeastern Indiana. One specimen known.

*Eutænia biscutata* Cope.

Proc. Acad. Phila., 1883, p. 21.

Lake Klamath, Oregon. Two specimens known.

*Eutænia elegans* Bd. and Gird.

Cat. Rept. N. Amer., Pt. 1, Serpents, 1853, p. 34.

*Eutania ragnans* Bd. and Gird., l. c., p. 35.

*Eutania marciana* Bd. and Gird. l. c., p. 36.

*Eutania couchii* Kenn., Rept. U. S. Pac. R. R. Surv.; Williamson's Rept., x, 1857, p. 10.

*Eutania hammondi* Kenn., Proc. Acad. Phila., 1860, p. 332.

*Tropidonotus trivittatus* Hallow., Proc. Acad. Phila., 1853, p. 257.

\**Eutania rutiloris* Cope, Proc. Am. Philos. Soc., 1885, p. 388. *Cozumel Id.*, Yucatan.



This species resembles in some of its forms the *E. sirtalis*, but it is to be always distinguished by the twenty-one rows of scales, the eight superior labials, and from most of the forms of the latter, by the absence of a series of rounded spots near the end of the gastral plates. In its range it never enters the eastern nor austroriparian regions, excepting the latter at the extreme western part of Texas, on the Concho and Nueces rivers and their tributaries.

The labial and scale formulæ in this species are quite constant. In two specimens of the *E. e. plutonia* the labials are eight, and the scales in twenty-one rows. In two of *E. e. elegans*, the figures are the same. In two of *E. e. brunnea*, the figures are the same. In eight of the *E. e. lineolata*, the figures are the same. In four of the *E. e. couchii* the figures are the same, except in one individual, where there are but nineteen rows of scales. In twenty-two specimens of *E. e. vagrans* there are twenty-one rows of scales in all, and in five specimens there are seven superior labials on one side. In one only are there seven superior labials on both sides. In all the others there are eight labials on both sides. In twelve specimens of *E. e. marcianna*, all have eight upper labials, and all but two twenty-one rows of scales. In two the scales are in nineteen rows. Thus in fifty-one specimens there are three departures from the regular scale formula; and one entire departure and five partial departures from the labial formula.

There are eight well marked color forms of this species, which mostly occupy distinct geographical regions, and are abundantly entitled to be called subspecies. It is indeed possible that some of these might be as well regarded as species, but the existence of transitions, and the lack of importance in the characters themselves, induce me to consider them as subspecies. They are, however, in the great majority of cases easily recognized. The characters of these forms are as follows:

- I. No spots; labials not dark bordered.
  - Black above and below; no lateral band; dorsal band wanting or a trace in front only.....*E. e. plutonia*.
  - Black above, light below; three distinct stripes, all black bordered...*E. e. elegans*.
  - Brown above, light below; three stripes, not distinctly bordered...*E. e. brunnea*.
- II. Spotted; labials not dark bordered; nuchal spots indistinct.
  - Stripes and spots distinct; the superior row of spots confluent into a band; the inferior separated by chestnut-red spaces; belly olivaceous...*E. e. ordinoides*.
  - Spots large anteriorly, smaller or confluent posteriorly; interspaces indicated by pale edges of the scales; bands distinct.....*E. e. lineolata*.
  - Spots small, numerous, 80-100, interspaces large, pale; bands present often indistinct; belly with dark middle.....*E. e. vagrans*.
- III. Spotted; labials dark bordered; nuchal spots more or less distinct.
  - No dorsal band, lateral band indistinct; intermediate space lead-colored with one row of spots next to the lateral band; yellow marks behind eye incomplete.....*E. e. couchii*.
  - Dorsal and lateral bands indistinct; three rows of spots on a light ground on each side; two yellow crescents extending upwards, at angle of mouth and behind eye.....*E. e. marcianna*.

Of these subspecies the *E. e. plutonia* has been found rarely and at remote localities, and the *E. e. brunnea* is only known from two specimens, so that these can not be yet regarded as geographical forms. The *E. e. elegans* has been found so far, in northern and central California only. The *E. e. lineolata* is from the same region, and from Oregon and Washington as well. The *E. e. vagrans* is characteristic of the entire region between the Sierra Nevada on the west and the eastern border of the Great Plains on the east, and belongs to higher parts of the Rocky Mountain ranges as well as to the valleys between them. The *E. e. couchii* is characteristic of southern California and southern Arizona and New Mexico. The *E. e. marciana* belongs to the valley of the Rio Grande, and adjacent regions in Texas and Mexico. It is seen from the above that the *Eutænia elegans* inhabits all of the nearctic realm excepting the eastern and austroriparian regions.

As regards transitions between the subspecies, I refer to the number of spots, which have been shown by Baird and Girard to be characteristic of the *E. e. vagrans* and *E. e. marciana*. In six specimens of the former, however, I find the variation to be from eighty-four to one hundred and three. In *E. e. marciana* they number from fifty-two to fifty-eight in four specimens, but in an otherwise typical one I find seventy-three. There is, however, still an interval between the ranges of variation. This is filled by the *E. e. couchii* where the number of spots runs from seventy-four to ninety-one in five individuals. The number of spots is thus characteristic in a general way, but not sufficiently exact to define the forms as species.

I have endeavored to ascertain whether there is any constancy in the number of temporal scales. Thus in the typical form, *E. e. elegans*, there are three rows of scales bordering the posterior superior labials above, while in the *E. e. lineolata* there are as often four as three. In the *E. e. vagrans* five specimens have four rows and five have three rows. In the *E. e. hammondii* three have three rows, and one (No. 866) has four. Of ten specimens of *E. e. marciana*, seven have three, and three have four. The rows always have the formula 1-2-3-4.

*Eutænia elegans plutonia* Yarrow.

*Eutænia vagrans angustrostris* Yarrow in Wheeler's U. S. C. G. Surv. W. 100th Mer. V. p. 554, Pl. xx, f. 2, 29.

*Eutænia henshawi* Yarrow, Proc. U. S. Nat. Mus. 1883, p. 152.

Two specimens known; one from western Arizona, and the other from Fort Walla Walla, Wash.

*Eutænia elegans elegans* Bd. and Gird.

*Eutænia elegans* Bd. and Gird., Cat. 1853, p. 35; Cope, Check List Batr. Rept. N. Amer., 1875, p. 41, *Tropidonotus trivittatus* Hallowell, Proc. Phila. Acad., 1853, 237.

Four specimens only known; all from California.

*Eutania elegans ordinoides* Bd. and Gird.

*Eutania ordinoides* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 33, *Tropidonotus ordinoides*, Bd. and Gird., Proc. Acad. Phila., 1852, 176.

This form is quite different from any of those enumerated as subspecies of *E. elegans*, but it resembles considerably the *E. sirtalis parietalis*. The distribution of colors is quite the same as in that form, but the red between the lateral spots is of a chestnut color, and not crimson, as in *E. s. parietalis*. The agreement of the scale and labial formulæ with those of the *E. elegans* induces me to refer it to that species rather than to the *E. sirtalis*, although the latter exhibits occasionally in California eight upper labials.

Besides the characters mentioned, this form has a yellow dorsal stripe, which is well defined, covering one and two halves rows of scales. The lateral stripe is defined below by a brown shade, which fades into the brownish olive of the belly below. The spots of the inferior lateral row are large and are confluent above with the wide black dorso-lateral band. No nuchal spots, but the dark color of the back continues into the brown of the top of the head. Superior labials brownish olive, the posterior narrowly brown-bordered; chin and throat yellow. Gastrosteges unspotted; one hundred and fifty-six in number. Tail injured; the base with a triangular section. Length of body, 490 millimeters.

One specimen from San Francisco, California. Baird and Girard enumerate three specimens, all from California, and two of them from San Francisco.

*Eutania elegans brunnea* Cope.

Color of the superior surface to the third row of scales (exclusive), brown; of lower surfaces, light yellow, extending to the third row of scales (inclusive). Dorsal stripe light yellow, occupying the median row of scales and the adjacent borders of the adjacent rows, but not well defined laterally, and not black bordered. It covers three full rows on the nape and only one row beyond the middle of the length, and is wanting on the tail. No traces of nuchal spots. Labials colored like the abdomen, the superior with traces of brown posterior borders. There is but a faint brown shade on the first row of scales and the ends of the gastrosteges, scarcely defluing the lateral stripe below. Belly unspotted. In the type No. 10849 the head is short, wide. Temporals 1-2-3 and 1-3-3. Gastrosteges 172, anal 1, urosteges 77. Genaeals equal, short. Tail entering total length four and one-tenth times.

This is a much more robust form than the *E. e. elegans*, and brown takes the place of black in the coloration. In the indefinite dorsal stripe it resembles the *E. e. lineolata*, but it does not show the least trace of the square spots even when the epidermis is removed.

Catalogue No.	No. of specimens.	Locality.	From whom received.	Nature of specimen.
10848	1	Fort Bidwell, Cal. ....	H. W. Henshaw .....	Alcoholic.
10849	1	.....do .....	.....do .....	Do.

*Eutaenia elegans lineolata* Cope.

Color above brown, to the third row of scales exclusive; below light olive, unspotted. A longitudinal dorsal stripe, and a lateral stripe on the second and third rows of scales, light yellow; first row of scales light brown; integument between the stripes marked with two rows of blackish square spots, which are, however, nearly invisible when the skin is not stretched, but are indicated by short, whitish borders of the scales, which occupy their interspaces. These spots are more distinct in the young, as in other forms. The brown of the sides extends to the head without forming nuchal spots, and passes from dark to lighter brown on the frontal region, or continues, especially in younger specimens, to the end of the muzzle. Superior labials yellowish olive, the middle ones with a trace of a dark posterior border above. A pair of parietal spots; gular region light yellow. Dorsal stripe faint on tail.

Temporals 1-2-3, or in some specimens 1-2-3-4. Tail three and four-fifths times in total length. Gastrosteges 168, anal 1, urosteges 89. Total length 460<sup>mm</sup>, of tail 120<sup>mm</sup> (medium sized specimen).

This a common form of eastern California and Oregon. It extends as far south as Fresno, California (No. 12564), and east as far as Walla Walla, Washington (10911). It connects completely the subspecies *E. e. elegans* and *E. e. vagrans*, in spite of their very different appearance. A specimen (11805) from Shasta County, California, is almost as uniformly black as the former; while 10911, from Walla Walla, approaches quite near to the *E. e. vagrans* in the dark, lead-colored middle abdomen.

*Eutaenia elegans lineolata* Cope.

Catalogue No.	No. of specimens.	Locality.	When collected.	From whom received.	Nature of specimen.
8579	2	Lake Tahoe, Nev. ....	Sept. —, 1876	Dr. W. A. Hammond, U. S. A.	Alcoholic.
8580	1	Southern California...	..... 1875	do .....	Do.
8587	1	do .....	Aug. —, 1875	do .....	Do.
9565	1	East California .....	.....	do .....	Do.
10840	1	Fort Klamath, Oreg. ..	Aug. 29, 1878	do .....	Do.
10843	1	Oregon .....	Sept. —, 1878	do .....	Do.
10844	1	do .....	Sept. —, 1878	do .....	Do.
10845	1	Camp Warner, Oreg. ..	Aug. 10, 1878	do .....	Do.
10846	1	do .....	Aug. 10, 1878	do .....	Do.
10847	1	Camp Bidwell, Cal. ....	July —, 1878	do .....	Do.
10848	1	do .....	July —, 1878	do .....	Do.
10849	1	do .....	July —, 1878	do .....	Do.
10850	1	do .....	July —, 1878	do .....	Do.
12564	1	Fresno, Cal. ....	.....	Gustav Eisen .....	Do.
10811	1	South Oregon .....	.....	H. W. Henshaw .....	Do.
10911	3	Walla Walla, Wash. ....	.....	Capt. C. E. Bendire, U. S. A.	Do.
		Baird, Shasta County,			
11805	1	Cal .....	.....	L. Stone .....	Do.

*Eutania elegans vagrans* Bd. and Gird.

*Eutania vagrans* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 35. Yarrow, Wheeler's Rept., U. S. G. Surv., W. 100th mer. v., p. 548; Cope, Check List, N. Amer. Batr. Rept., 1875, p. 41.

The entire central region, and not elsewhere, except a few specimens from the northern part of the Pacific region; extending as far south as the mountains of New Mexico and Arizona, and Humboldt Bay, California. Very abundant.

*Eutania elegans couchii* Kennicott.

*Eutania couchii* Kenn., Rept. U. S. Pac. R. R. Surv., x, Williamson's Rept., p. 10, 1857. *Eutania hammondi* Kennicott, Proc. Acad., Phila., 1860, p. 332.

This subspecies is easily recognized, and intermediates between *E. e. vagrans* and *E. e. marciiana*. An approach is made to the markings of the head seen in the latter, while it resembles the young of *E. e. vagrans* in this respect also. The same *E. couchii* was based on an exceptionally narrow nosed form from northern California (Pitt River), of which but one specimen has been found. The normal form (*E. e. hammondi*) is characteristic of southern California, ranging east to Texas.

*Eutania elegans marciiana* Bd. and Gird.

*Eutania marciiana* Bd. and Gird., Cat. Serpt. N. Amer. 1853, p. 36. Cope, Check List N. Amer. Batr. Rept. 1875, p. 41.

This easily recognized subspecies is restricted to the valley of the Rio Grande from Colorado to its mouth. It extends eastward into Texas as far as the Concho and Nueces Rivers.\*

*Eutania cyrtopsis* Kennicott.

Proc. Acad. Phila., 1860, p. 333, Cope, Check List N. Amer. Batr. Rept. 1875, p. 41. *Tropidonotus collaris* Jan, Icon. Gen. d. Ophidi II, 25 v, Fig. 2 (too stout).

This species inhabits the Sonoran, Lower Californian, and Mexican regions. It is well characterized by its wide head and slender body with large eye, large nuchal spots and dorsal stripes running on only one row of scales. There are three subspecies, which differ as follows:

I. Tail about one-third the total length. No large spots below lateral stripe.

*E. e. cyrtopsis*.

II. Tail between one-fourth and one-fifth the length.

No large spots below lateral stripe.....*E. e. collaris*.

Large spots below lateral stripe alternating with lower lateral spots, and invading lateral stripe .....*E. e. ocellata*.

*Eutania cyrtopsis cyrtopsis* Kennicott.

*Eutania cyrtopsis* Kenn., Proc. Acad. Phila., 1860, p. 533. Cope, Check List N. Amer. Batr. Rept. 1875, p. 41.

From Durango, Mexico.

\* *EUTANIA AUGUSTIROSTRIS* Kennicott. Proc. Acad. Phila., 1860, p. 332. Cope, Check List N. Am. Batr. Rept. 1875, p. 41. One specimen known; from Durango, Mexico.

*EUTANIA CHRYSOCEPHALA* Cope, Proc. Amer. Philos. Soc., 1884, p. 173. Orizaba, Vera Cruz, Mexico.

*Eutænia cyrtopsis collaris* Jan.*Tropidonotus collaris* Jan, Iconographia degli Ofid. II, 25, Pl. v, Fig. 2.

Mexico generally; Lower California; Arizona (Camps Whipple and Verde); New Mexico (Lake Valley.)

*Eutænia cyrtopsis ocellata* Cope.

Bull. U. S. Nat. Mus., No. 17, p. 22, 1880.

Helotes, West Texas; several specimens.

*Eutænia infernalis* Blainville.*Coluber infernalis* Blv., Nouv. Ann. Mus. His. Nat. Paris, III, 1834, p. 59, Pl. xxxiv A, Fig. 33a; Bd. and Gird., Cat. 1853, p. 26.

This species occupies a position intermediate between the *E. elegans* and the *E. sirtalis*, having the labial plates of the former and the scale formula of the latter. In color pattern it differs from all the subspecies of either, and as its tail is generally longer than either, it is necessary to admit it as a separate species. It is more than usually compressed at the anal region, where the scales are wide and more irregular than is observed in other species. In the form *vidua* this compression extends to the entire body. There are two well-marked subspecies as follows:

Color blackish, with traces of an inferior row of spots, and a distinct lateral stripe; belly yellowish olive with black center; throat and lips yellow .. *E. i. infernalis*.  
Uniform black, with yellow dorsal stripe only ..... *E. i. vidua*.

a. *Eutænia infernalis infernalis* Blv.*Eutænia infernalis* Bd. & Gird., Cat. 1853, p. 26, Blainville, l. c.; *Coluber infernalis* Blainville, Nouv. Ann. Mus. d'Hist. Nat., III, 1834, p. 59; Pl. xxiv, 33a.

Head moderately distinct, muzzle medium. Parietal plates not shortened, narrowed posteriorly. Scales not narrow, graduating in width from the first row, which is smooth. Gastrosteges 158, anal 1, urosteges 70.

Color a blackish brown, with a median yellow stripe, which covers the middle and parts of adjacent rows to the base of the tail, where it contracts to one row and continues to the end. Belly from yellow to olivaceous, extending to the third row of scales inclusive, with or without a shade on the first row distinguishing a lateral stripe, immaculate. Scales from fourth to eighth rows inclusive, with the keels olivaceous or yellowish forming delicate longitudinal lines. Shades of the same color are so distributed on the scales as to give the appearance of indistinct spots in two rows, an appearance which is increased by a few scattered yellowish dots on the margin of some of the scales. This appearance represents actual spots in some specimens. In some of the larger specimens the appearance is lost, nothing but the few yellow specs remaining. Labial plates yellow or olive, with or without very narrow posterior black borders. Throat and chin always yellow.

In eleven specimens from Fresno, Cal., only the smaller ones have distinct indications of lateral spots. In five from near San Francisco, Cal., the spots remain distinct in the adults, as in the type of Baird and Girard.

This subspecies resembles the *Eutænia elegans lineolata*, but it has always (sixteen specimens) one row of scales less on each side; the dorsal stripe is wide and better defined, and the colors are much brighter.

*Eutænia infernalis infernalis* Bd. and Gird.

Catalogue No.	No. of specimens.	Locality.	Whence obtained.	Character.
11754	11 6	Fresno, Cal. .... San Francisco .....	G. Risen ..... Collins Overland Telegraph Co.	Alcoholic. Do.

Besides the six specimens of this form, said to be from San Francisco, Baird and Girard enumerate two from California.

*b. Eutænia infernalis vidua* Cope.

Body moderately robust, compressed to the base of the tail; head moderately distinct; muzzle moderately elongate. Tail from  $3\frac{3}{4}$  to  $3\frac{1}{2}$  times in total length, compressed for the basal half. Scales in nineteen rows graduating in size from the first on each side, which is as deep as wide and very feebly keeled. Other scales not very elongate, feebly notched. Superior labials eight, all higher than long. Loreal not longer than high; oculars 1-3, temporals 1-2-3; one of the second row larger than the rest. Geniæ narrow, subequal. Frontal short, twice as wide as the superciliaries anteriorly. Scuta, 151-177.

Color black, without markings, excepting a yellow olivaceous throat and chin, and a yellow dorsal stripe which covers one and two half rows of scales from the parietal plates to the basal third of the tail, whence it runs on a single row to the end of the latter. Muzzle and labial plates uniform lead color; throat yellowish.

This species is so far known from the two original specimens only, which are in excellent preservation. It resembles in general characters the species of the *E. sirtalis* group, but is quite different from any of the forms which I have included in that protean species. The tail is longer, as I find out of ninety-seven specimens of the latter which I have measured; but five have the tail as short as in the specimen of *E. vidua*, with the shortest tail ( $3\frac{3}{4}$ ), and none with so long a tail as the other ( $3\frac{1}{2}$ ). The eight superior labials distinguish it from all but four specimens of the ninety-seven, and in some of them the additional labial is an intercalation. Two of these four specimens come from the same locality, viz, San Francisco. The compressed body is seen in a few specimens of the *E. sirtalis*, also from the Pacific region, but not in any other forms. In some of these the stripes disappear, but altogether, and not the lateral only, leaving a well-developed dorsal, as in the *E. s. vidua*.

The coloration is a curious parallel of the "*atrata*" form of the *E. leptocephala*, which it closely resembles. The superior labials of the latter are different in being lighter and with black borders, and the throat is whitish and the muzzle brown.

While the *E. infernalis* has these points of connection with certain extremes of variation of the *E. sirtalis*, it agrees with none of them, and may be regarded as a species until more definite points of connection are found.

*Eutænia infernalis vidua* Cope.

Catalogue No.	No. of specimens.	Locality.	From whom.	Character.
970	2	San Francisco .....	.....	Alcoholic.

Two specimens in the U. S. National Museum are the only ones that I have seen. Both are from San Francisco, California.\*

*Eutænia aurata* Cope, sp. nov.

Form of medium robustness; head well distinguished; tail about  $4\frac{1}{2}$  times in total length. Scales in nineteen series, those of the inferior row as deep as long, smooth or feebly keeled; the transverse diameter of the scales diminishing gradually, and nowhere so small as in many other species. Superior labials eight, all deeper than long. Loreal deeper than long; oculars 1-3; temporals 1-2-3. Frontal wider than superciliaries, not reaching preocular.

Brown without spots, and with three longitudinal yellow stripes, the lateral very distinct, and running on the second and third rows of scales. Belly yellow, immaculate. Labials yellow. A pair of large black nuchal spots.

This species differs from those of the same group with short tail, in its more robust form, and in the absence of spots and presence of stripes. In its large nuchal spots it resembles the *E. cyrtopsis*, but in no other respect. Its real affinities are to the *E. infernalis*, but its appearance is very unlike this form.

Robust, head short, distinct. Anterior labials short, vertical; parietal plates rather short and wide. Scales rather wide, first row very weakly keeled. Gastrosteges 168, anal 1, urosteges 74. Total length 840<sup>mm</sup>; length of tail 185<sup>mm</sup>.

The color is a rich uniform brown above, with three longitudinal yellow stripes which are without black borders. The dorsal stripe occupies the middle and parts of two adjacent rows of scales on the anterior half of the length, and one row on the posterior half, and is continued to the end of the tail. The lateral stripe covers two entire rows

\*EUTÆNIA PHENAX Cope, Proc. Acad. Phila., 1863, p. 134. Vera Cruz, Mexico.

EUTÆNIA SUMICHRASTII Cope, Proc. Acad. Phila., 1866, p. 306; Proc. Amer. Philos. Soc., 1864, p. 175. State of Vera Cruz, Mexico. †Guatemala, Digitized by Google



of scales except on the posterior half, where it occupies the second row only. It is bordered below by a band of a rather lighter brown than that of the space above it, on the first row of scales, and on the angles of the gastrosteges, which enter between the separate scales of the latter. Every other scale of the first row has a black speck at its upper and lower base. Belly immaculate yellow, except a black shade at the base of the extremity of a few of the scuta, which is only visible on stretching the latter apart.

This handsome form resembles the *Eutænia elegans brunnea* in general form and appearance, but the latter has no nuchal spots nor black labial borders, nor band beneath the lateral stripe. It belongs to a different section of the genus. Its nuchal spots and labial borders are like those of the *Eutænia cyrtopsis*, but it is not a slender-bodied species, and the scales are wider than in that form, representing a different type in the genus.

I have seen but one specimen of this subspecies, which I took near Lake Valley, in southern New Mexico. There is no specimen in the U. S. National Museum.

***Eutænia leptocephala* Bdl. and Gird.**

Cope in Yarrow's Reptilia, Vol. v; Rep. U. S. G. G. Surv. W. of 100th Mer., p. 550; Catalogue of Serpents, 1853, p. 29; Proc. Acad. Phila., 1853, p. 23; *Eutænia cooperii* Kennicott, U. S. Pac. R. R. Surv., xii, Pl. ii, p. 296; Cope, l. c., 551; *Eutænia atrata* Kennicott, loc. cit.; *Tropidonotus sirtalis*, var. *leptocephala*, Jan. Icon. Gen. Ofid., ii, 25; iv, Fig. 2.

This is a diminished or depauperate form of the *E. sirtalis* series, with a tendency to reduction in the number of the scale rows and labial plates, and subdivision of the preocular plate. Of twenty-four specimens twelve have nineteen, and twelve have seventeen rows of scales. The latter character has given rise to the synonym *E. cooperii*. Rather less than half the specimens have two preoculars, while in about one-fourth, a fusion of two or more of the superior labial plates on one or both sides is seen, reducing the number to six or five. The two most frequently fused are the third and fourth, which bound the orbit below, and next, the fifth is fused with the fourth.

The stripes are sometimes very distinct and the spots fused into a black band between them, and all stages exist between this condition and that in which the colors are light and both stripes and spots are indistinct. All the specimens come from the coast region of the Pacific district north of Humboldt Bay, California.\*

\* *EUTÆNIA SCALARIS* Cope, Proc. Acad. Phila., 1866, p. 306; *Thamnophis scalaris* Cope, l. c., 1866, p. 369. States of Puebla and Vera Cruz, Mexico.

*EUTÆNIA PULCHRILATUS* Cope, Proc. Amer. Philos. Soc., 1884, pp. 173, 174. States of Mexico, Hidalgo, Puebla, and Vera Cruz, Mexico.

*Eutaenia sirtalis* Linn.

Bd. and Gird., Cat. Serpt., 1853, p. 30; Cope Check List N. Amer. Batr. Rept., 1875, p. 41.

*Coluber sirtalis* Linn., Syst. Nat., I, 1766, p. 383.

*Tropidonotus sirtalis* Holbrook, N. Amer. Herpetology, III, 1842, 41, Pl. XI.

*Coluber ordinatus* Linn., Syst. Nat., I, 1766, p. 379; Merrem Teutamen, p. 93.

*Tropidonotus ordinatus* Boie, Isis von Oken, 1827, p. 535; Holbrook N. Amer. Herpet., IV, Pl. 12; Günther, Cat. Colubr. Snakes Brit. Mus., 1858, p. 63.

*Tropidonotus bipunctatus* Schlegel, Physionomie des Serpents, 1837, 320; Dum. Bibr. Erp. Gen., VII, 1854, p. 582.

This species ranges over all North America, being limited to the North by its capacity for enduring cold, and extending south to Mexico. In its essential characters it is quite constant, but it varies in color so as to include several races or subspecies. Of one hundred and two specimens examined, but three have twenty-one rows of scales, the rest having nineteen. Of the same number examined, but six have eight superior labials on both sides, and the additional labial is generally smaller than the others, so as to be an evident abnormality, though sometimes they are regular. In nine specimens the additional labial appears on one side only. These abnormalities are distributed as follows:

	No. exam-ined.	21 rows scales.	Sup. labs. 8-8	Sup. labs. 8-7.
<i>E. s. dorsalis</i> .....	6	0	0	1
<i>E. s. sirtalis</i> .....	53	1	3	4
<i>E. s. parietalis</i> .....	37	2	2	4
<i>E. s. pickeringii</i> .....	8	0	1	0
Total .....	102	3	6	9

## The subspecies differ as follows:

## I. No stripes nor spots above.

Color green; a spot near end of each gastrostege ..... *E. s. graminea*.

## II. No stripes; two rows of square spots on each side.

Spots all distinct, not separated by red interspaces; gastrostegal spots.

*E. s. ordinata*.

## III. Both stripes and spots.

Spots all distinct, not separated by red interspaces; gastrostegal spots; dorsal stripe yellowish, not black bordered ..... *E. s. sirtalis*.

Spots distinct, not separated by red interspaces; the anterior become opposite and confluent, and extending across the lateral stripe forming half cross-bars; gastrostegal spots..... *E. s. semifasciata*.

Inferior row of spots only visible; separated by red interspaces; dorsal stripe red, black bordered; gastrostegal spots..... *E. s. dorsalis*.

Superior row of dorsal spots confluent into a longitudinal band in contact with the inferior row of spots, which are separated by red interspaces; no gastrostegal spots..... *E. s. parietalis*.

Like the last, but the inferior spots connected below by a black band inclosing the red spots; throat and lips red; belly black..... *E. s. concinna*.

Three longitudinal lines on the middles of the second and median rows of scales, mostly blue; belly black..... *E. s. pickeringii*.

## IV. Bands but no spots.

Four longitudinal black stripes separated by a red stripe on each side.

*E. s. tetratenia.*

Three well defined bluish bands of usual width; belly black.... *E. s. trilineata.*

A yellow dorsal band; the lateral less distinct; belly green and with gastrotegal spots ..... *E. s. obscura*

These subspecies are distributed as follows:

Eastern region.	Austroriparian region.	Central region.	Pacific region.
<i>E. s. graminea.</i>			
<i>E. s. ordinata</i> .....	<i>E. s. ordinata.</i>		
<i>E. s. sirtalis</i> .....	<i>E. s. sirtalis</i> .....	<i>E. s. dorsalis.</i>	
		<i>E. s. parietalis</i> .....	<i>E. s. parietalis.</i>
<i>E. s. semifasciata</i> .....			<i>E. s. concinna.</i>
<i>E. s. obscura</i> .....	<i>E. s. obscura</i> .....		<i>E. s. tetratenia.</i>
			<i>E. s. trilineata.</i>
			<i>E. s. pickeringii.</i>

***Eutænia sirtalis graminea* Cope.**

Proc. U. S. Nat. Mus., 1888, p. 399.

Found rather rarely from Massachusetts to Indiana, inclusive.

***Eutænia sirtalis ordinata* L.**

Cope, Check List N. Amer. Batr. Rept., Bull. U. S. Nat. Mus., 1, 1875, p. 41; Wheeler's Surv. Zoölogy, v., p. 546.

*Coluber ordinatus* Linn., Sys. Nat. 1, 1866, 379; *Tropidonatus ordinatus* Holbrook, N. Amer. Herpetol., III, 1842, 45 Pl. XII. *Eutænia ordinata* Bd. and Gird., Cat. 1853, p. 32.

Found sparingly throughout the Eastern and Austroriparian regions except Texas.

***Eutænia sirtalis sirtalis* Linn.**

Cope, Check List N. Amer. Batr. Rept., Bull. U. S. Nat. Mus., 1, 1875, p. 41: do. in Yarrow's Rept. U. S. G. G. Exp. Surv. W. 100th Mer., Vol. v, p. 546.

*Eutænia sirtalis* Bd. and Gird. Cat. 1853, p. 20.

Found throughout the Eastern and Austroriparian regions except Texas. The most western locality known is Fort Kearney, now Junction City, in the eastern third of Kansas. This form reaches a larger size than any other species or subspecies. A melanistic specimen from Tennessee is in the U. S. National Museum. All parts of the body are black, but the spots and stripes may be all traced.

***Eutænia sirtalis semifasciata* Cope, subsp. nov.**

This subspecies or geographical race is represented by a number of specimens in the national collection from northern Illinois and Wisconsin. It resembles in general the *E. s. sirtalis* in color and proportions. The lower surface and the stripes are olivaceous, and the lateral and median stripes are separated by two rows of spots which occupy the entire width of the space on the skin, but which do not touch each other as scale markings, the upper row being ranged along the median stripe, and the lower along the lateral stripe. The peculiarity of the

form consists in the fact that on the anterior fifth or sixth of the length of the body the spots of the inferior row extend across the lateral stripe, breaking it up into sections. In many of the specimens the spots of the superior row become opposite to those of the inferior row, and join them, and the latter again join a row which is below the lateral stripe. The three rows of spots thus become confluent, form cross bars interrupted only by the median dorsal stripe, as in the *Eutania scalaris*. The bars are much less regular than in that species, the part that crosses the lateral stripe being distinctly contracted, and the superior part being much widened.

In four specimens (8070) of this form the tail measures, respectively,  $4\frac{1}{2}$ ,  $4\frac{2}{3}$ ,  $4\frac{2}{3}$ ,  $4\frac{5}{8}$  of the total length. Gastrosteges in one of the same, 153; anal 1; urosteges 61. Length of same specimen, 520 millimeters; length of tail, 104 millimeters. Length of a larger specimen, 914 millimeters; of tail, 196 millimeters. In several of the specimens a delicate black line borders the median stripe on each side.

Catalogue No.	No. of specimen.	Locality	From whom received.	Nature of specimen.
8070	24	Aux Plaines, Ill. ....	R. Kennicott. ....	Alcoholic.
1018	2	.....do.....	.....do.....	Do.
1051	1	Wisconsin .....	.....?.....	Do.

In the lot 8070 are included three specimens of the *E. sirtalis sirtalis*.

*Eutania sirtalis dorsalis* Bd. and Gird.

*Eutania dorsalis* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 31, Cope Check List N. Amer. Batr. Rept., 1875, p. 41. *Eutania ornata* Bd. and Gird., Yarrow Reptilia U. S. G. G. Ex. W. 100th mer. v, p. 550-553; Check List N. Amer. Batr. Rept. Bull. U. S. Nat. Mus., No. 24, 1883, p. 122; not of Bd. and Gird. *Tropidonotus sirtalis* var. *dorsalis*, Jan, Icon. Gen. Ofid. II 25, IV, fig. 1.

This form, which is easily distinguished in life by its red dorsal stripe, inhabits principally the Rio Grande Valley, being associated with the *E. elegans marciana*. It is nearest to the *E. s. parietalis*, but it lacks the wide black band on each side of the dorsal stripe which is in contact with the lower series of lateral spots in that form. It has instead, a narrow black border of the dorsal stripe, which does not touch the small distinct lateral spots. Intermediate forms, however, occur, in which the black borders are wider and the lateral spots larger. Such is No. 954, from Salt Lake, Utah, and another specimen from California.

*Eutania sirtalis obscura* Cope.

Check List N. Am. Batr. Rept., 1875, p. 41, in Yarrow's Report Reptiles U. S. G. G. Survey W. of 100th mer., 1875, v, p. 546.

This form is a derivation from both *E. s. sirtalis* and *E. s. parietalis* by a fusion of the spots into black bands. The specimens in the National Museum are from remote localities, viz.: Westport, Nova Scotia; Lac que Parle Minn.; Fort Benton, Mont. and California.

*Eutænia sirtalis parietalis* Say.

Cope in Yarrow's Report Reptiles U. S. G. G. Survey W. of 100th mer., v, 1875, p. 546; *Coluber parietalis* Say in Long's Exped. Rocky Mtns., 1823, 1, p. 186; Harlan Journ. Acad. Phila., v, 1827, p. 349. *Eutænia parietalis* Bd. and Gird., Cat. 1-53, p. 28. *Eutænia pickeringii* Bd. and Gird., Cope Proc. Acad., Phila. 1883, p. 21; Check List N. Am. Batr. Rept., 1875, p. 41, not of Bd. and Gird. *E. ornata* Bd. and Gird., U. S. Mex. Bound. Surv., II, Rept. 1859, p. 16, pl. —, fig. —.

This subspecies covers the entire central region, and the Pacific region. It is most abundant in the northern part of the latter, but is found as far South as Fresno, Cal.

*Eutænia sirtalis concinna* Hallow.

*Tropidonotus concinnus* Hallowell, Proceed. Acad. Phila., vi, 1852, p. 182; *Eutænia concinna* Bd. Gird., Cat. 1853, p. 146; Cope, Proc. Acad. Phila., 1883, p. 23.

From the western part of Washington and Oregon.

*Eutænia sirtalis tetratænia* Cope.

In Yarrow's Report in U. S. Expl. Surv., W. of 100th mer., v, 1875, p. 546.

In the typical specimen the tip of the tail is injured, but it can be restored with considerable probability, so that I estimate that the length enters the total length four and one-fifth times. The superior labials eight, the anterior rather crowded, so that it may be that the normal number is seven instead of eight, in which case this form should be referred to the *E. sirtalis* rather than to the *E. infernalis*. The loreal is as high as long, and the temporals are 1—2—3: The frontal is wider than the superciliaries, and does not reach the preocular. The post-genials are longer than the pregenials. Gastrosteges, 158; urosteges, 68 +. Total length, 800 millimeters; of tail (tip lost), 118 +.

The ground color is seen in the dorsal stripe and in the belly as high as the third row of scales inclusive. This is bluish olivaceous. The scales mentioned are black at their bases and on their adjacent edges, and in the first row of scales the black covers the angular extremity of the gastrosteges. No regular spots on the gastrosteges, as in most subspecies of *Eutænia sirtalis*. There is no distinct lateral stripe. The dorsal stripe covers one and two half rows of scales. Externally on each side it is bounded by a black stripe, which also covers one and two half rows of scales, and which extends to the base of the tail. Exterior to this on each side is a red stripe, which also covers one and two half rows of scales. Exterior to this on each side is a second black stripe on each side which covers one and a half rows of scales and extends to the base of the tail, beyond which it is broken up into a series of black spots. It is also broken up into spots for a short distance posterior to the head. These spots have no connection with the superior black band. Head olive gray with two pale parietal spots; no nuchal spots. Superior labials with narrow black posterior borders on the fourth, fifth, and sixth. Throat and chin yellowish, unspotted. No black marks on middle of belly and tail below.

The color pattern of this subspecies is entirely different from that of any other and is the result of a confluence of the spots, one phase of which is seen in the *E. sirtalis concinna*. As in that form, the inferior row of spots has become a longitudinal band, but, unlike that form the red spaces between the superior row of spots, has also become a stripe instead of remaining separate.

*Eutænia sirtalis tetrænia* Cope.

Catalogue No.	No. of specimens.	Locality.	Whence obtained.	Remarks.
866	1 2	Puget Sound, Wash. Pitt River, Cal.		Alcoholic. do.

*Eutænia sirtalis pickeringii* Bd. and Gird.

Cope in Yarrow's Rept. U. S. G. Survey W. of 100th Mer., v, p. 546; *Eutænia pickeringii* Bd. and Gird. pt., Cat. 1853, p. 27; Cope, Check List N. Amer. Batr. Rept., 1875, p. 41.

Two specimens only known, both from Puget Sound, Washington.

*Eutænia sirtalis trilineata* sub. sp. nov.

General color above and below black. Three longitudinal bluish stripes present, of the usual width; *i. e.*, the lateral on the second and third, and the dorsal on the median, and the half of each adjacent row of scales. Middle of belly lead colored. Head black.

This form resembles the *E. s. pickeringii*, but has the stripes of the usual width. It differs from the *E. s. obscura* in the black belly and well-defined lateral stripe.

Five specimens have come under my observation: No. 5274 (1) from Port Townsend, Oregon, and 5493 (4) from Fort Benton, Montana.

*Eutænia nigrilatus* Brown.

Proc. Acad. Phila., 1889, p. 421.

From Tucson, Arizona; one specimen known.

*Eutænia multimaculata* Cope.

Proc. Amer. Philos. Soc., 1885, p. 284; *Atomarchus multimaculatus* Cope, American Naturalist, 1883, p. 1300.

From Southern New Mexico and Arizona and Chihuahua, Mexico.\*

\* EUTÆNIA MELANOGASTER Cope, Proc. Amer. Philos. Soc., 1885, p. 386. *Tropidonotus melanogaster* Weigmann, Peters, Monatsber. Ak. Sci. Berlin, 1864, 389. *Atomarchus melanogaster* Wieg. Cope. *Tropidonotus mesomelanus* Jan, Icon. Gen. Ofid., II, 27, v, Fig. 3; VI, Fig. 2. The valley of Mexico.

**Eutaenia rufopunctata** Cope.

*Chilopoma rufopunctatum* Cope, Report U. S. Expl. Surv. W. of 100th Mer., v, Reptiles, by Yarrow, 1875, p. 544; *Tropidonotus rufopunctatus* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 136. *Stypocemus rufopunctatus* Cope, Proceeds. Amer. Philos. Soc., 1885, p. 387.

Southern Arizona.

**TROPIDOCLONIUM** Cope.

Proc. Acad. Phila., 1860, p. 76; Proc. Amer. Philos. Soc., 1886, p. 495; Bull. U. S. Nat. Mus., 1887, p. 60; *Microps* Hallow.. Proc. Acad. Phila., 1856, p. 241.

Head not distinct from body. Teeth equal. Scales keeled; and subcaudal scuta divided. Cephalic scuta normal; two internasals, rostral not prominent. One nasal, one loreal, one preocular. Anal plate entire.

This genus shows its position to be in the Natricinæ by the presence of the vertebral hypapophyses on the posterior centra; and in its pattern of coloration it resembles the genus *Eutaenia*, and especially such a species as *E. leptcephala* Bd. and Gird., where the head is not very distinct. It is probably a terrestrial modification of that genus, as the *Clonophis kirtlandii* is of *Natrix*. But one species of the genus is known. The *T. storckii* has a divided anal and must be placed in *Natrix*.

**Tropidoclonium lineatum** Hallow.

Cope, Proc. Acad. Phila., 1860, p. 76; Check List Batr. Rept. N. Amer., 1875, p. 42; *Microps lineatus* Hallowell, Proc. Acad. Phila., 1856, p. 241

This species is especially characteristic of the western part of the Mississippi Valley, occurring in both the eastern and central regions. It is not uncommon in northern Texas, the Indian Territory, and southern Kansas, extending north to Iowa inclusive.

**LIODYTES** Cope.

Proc. Amer. Philos. Soc., 1884, p. 194; loc. cit., 1886, p. 495; Bull. U. S. Nat. Mus. 32, 1887, p. 60.

Posterior maxillary tooth longer than those in front of it and separated from them by an interspace. Cephalic plates normal, except that there is but one internasal plate. Nostril subvertical. Two nasal plates and one loreal. Scales smooth, no fossæ. Anal scutum divided.

This genus is allied to *Helicops* Wagler, a form found only in continental South America. It differs from it in the smoothness of the scales.

It includes but one species, which has been found so far in Florida only.

Scales in eighteen rows; labials eight; internasal wider than long. Five rows of caudal scales keeled. Dark brown, with two lateral brownish-yellow stripes on each side; below straw color..... *L. allenii*.

***Liodytes allenii* Garman.**

Cope, Proc. Amer. Philos. Soc., 1886, p. 495.

*Helicops allenii* Garman., Proc. Bost. Soc. Nat. Hist., 1874, 92; Cope, Check List Bat. Rept. N. Amer., 1875, p. 43.

Florida only.

**NATRIX** Laurenti.

Specimen Synopsis Reptilium, 1768, p. 73; Bonaparte, Fauna Italica, 1840, pp. 172, 173; Cope, Proceeds. U. S. Natl. Mus., 1888, p. 392. *Tropidonotus* Kuhl, Isis von Oken, 1826, p. 205; Boie, loc. cit., 1827, p. 518; Wagler, Systema, 1830, p. 179; Schlegel, Physionomie des Serpens, 1837, 296; Duméril et Bibron, Etp. Généralé, VII, pp. 549-724, 1854; Günther, Cat. Brit. Mus., 1858, p. 59; *Nerodia* Bd. and Gird., Cat. Rept. Serpents, 1853, p. 38; *Regina* Bd. and Gird., loc. cit., p. 45.

Teeth generally longer on the posterior than the anterior parts of the maxillary bone, ungrooved. Two internasal, two prefrontal, and two nasal scuta; one loreal; parietals distinct. Anal plate divided. Scales keeled; scale-pits double. Gastrosteges well developed, not angulated or keeled.

This genus is widely distributed throughout the northern hemisphere, embracing numerous species in North America and in Eurasia, but is wanting on the Pacific district of the former. On the American continent a single species, *N. rhombifer* Hallow., extends as far south as Vera Cruz from its North American range.

I find twelve well distinguished species in North America, which are characterized as follows:

I. Temporal scuta 1-2 or 3; parietal scuta normal.

α Oculars 2-2; scales in nineteen rows.

Smaller, muzzle wider; three black stripes above; four brown ones below.

*N. leberis.*

• Larger, muzzle narrower; no black bands above; two, sometimes three or four, imperfect bands below ..... *N. grahamii.*

Muzzle short; brown above with a broad median band; below yellow, with two rows of spots ..... *N. rigida.*

αα Oculars 1-2; scales in twenty-one rows.

Superior labials eight; head elongate; brownish yellow, immaculate. *N. usta.*

ααα Oculars 1-3; scales in 19-21 rows.

Four brown bands above; a median row of yellowish spots below. *N. clarkii.*

Three rows of brown spots above, which may form stripes anteriorly and cross-bands posteriorly; median row of yellow spots below.

*N. compressicauda.*

A row of lateral spots, often indistinct; below, uniform; tail slender, cylindrical. .... *N. valida.*

αααα Oculars 1, 2-3; scales in 23-25 rows.

Superior labials nine; preoculars two; spots longitudinal. .... *N. bisecta.*

Superior labials eight; preoculars one; spots, when present, transverse.

*N. fasciata.*

ααααα Oculars 1, 2-3, 4; scales in 27-29 rows.

Eye resting on (usually) one labial; alternating wide dorsal and lateral spots, connected at angles ..... *N. rhombifera.*

Eye separated from labials by scales; numerous narrow cross-bands, sometimes broken ..... *N. cyclopium.*



## II. Temporal scales 2, 4-5; parietals much reduced in size.

α Oculars 1-2; scales 31-33 rows.

Eye resting on one labial; alternating dorsal and lateral square spots which do not touch ..... *N. tarispilota*.

Of these species *N. leberis* and *N. fasciata* are distributed over both the eastern and the Austroriparian districts. The other species belong to the Austroriparian district, except the *N. valida*, which is the only species of the Sonoran district. The *N. grahamii* extends up the Mississippi River to north of the Austroriparian limits to northern Illinois and Indiana, and is not known from east of the latter State. *N. rhombifera* has a similar distribution, except that it remains within the boundaries of the Austroriparian district, not extending north of southern Illinois and Indiana. *N. cyclopius* has not been found out of this district, while the *N. compressicauda* and *N. usta* are restricted to Florida. *N. tarispilota* is confined to the eastern part of the Austroriparian region and Florida; while *N. rigida* has a similar range, omitting Florida, and apparently extending north to Pennsylvania. *N. bisecta* is known from but one specimen.

**Natrix leberis** Linn.

*Coluber leberis* Linn., Syst. Nat., Ed. xi, 1766, 216; Gmel., Linn. Syst. Nat., Ed. xiii, lxi, 1788, 1086; Shaw, Gen. Zool., iii, pt. 2, 1802, p. 433; Daudin, Hist. Nat. Rept., vi, 1803, 218.

*Tropidonotus leberis* Holbr., N. Amer. Herpt., iv, 1842, 118, Pl. xii; DeKay, N. York Fauna Rept., 1842, 45; Pl. xi, Fig. 23; Dum. Bibr., Erp. Gen., vii, 1854, 579; Günther, Cat. Col. Snakes, Brit. Mus., 1858, p. 78; Jan, Icon. Gen. Ofid., ii, 27, v, Fig. 2.

*Regina leberis* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 45.

*Coluber septemvittatus* Say, Journ. Acad. Phila., 1825, p. 243; Harlan, l.c., 1827, p. 355.

Eastern and Austroriparian regions.

**Natrix grahamii** Bd. and Gird.

*Regina grahamii* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 47.

*Tropidonotus grahamii* Günther, Cat. Col. Snakes Brit. Mus., 1858, p. 78; Cope, Check; List Batr. Rept. N. Amer., 1875, p. 42; Jan, Icon. Gen. Ofid., ii, 27, v, Fig. 1.

Austroriparian region.

**Natrix rigida** Say.

*Coluber rigida* Say, Journ. Acad. Phila., 1825, p. 39; Harlan, l. c., 1827, p. 355.

*Tropidonotus rigidus* Holbr., N. Amer. Herpt., 1842, iii, p. 39, Pl. x.

Cope, Check List Batr. Rept. N. Amer., 1875, p. 42.

Austroriparian region.

**Natrix usta** Cope.

Proc. U. S. Nat. Mus., 1888, p. 392; *Tropidonotus ustus* Cope, Proc. Acad. Phila., 1860, p. 340.

Florida.

**Natrix clarkii** Bd. and Gird.

*Regina clarkii* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 48; *Tropidonotus clarkii*. Cope, Proc. Acad. Phila., 1861, p. 74: Check List Batr. Rept. N. Amer., 1875, p. 42.

*Tropidonotus medusa* Günther, Cat. Col. Snakes Brit. Mus., 1858, p. 78.

Texan district of Austroriparian region, east to New Orleans.

**Natrix compressicauda** Kenn.

Cope, Proc. U. S. Mus., 1888, p. 392; *Nerodia compressicauda* Kennicott, Proc. Acad. Phila., 1860, p. 335; *Tropidonotus compressicaudus* Cope, Check List N. Amer. Batr. Rept., 1875, p. 42.

**Florida.**

Scales in nineteen rows; above, blackish brown with numerous closely placed pale cross-bands; one row of yellow gular spots..... *N. c. compsolæma*.

Scales in twenty-one rows; numerous dark cross-bands, narrowed on the side; three gular yellow bands; a postocular band..... *N. c. bivittata*.

Scales in twenty-one rows; three rows of dorsal brown spots forming longitudinal bands on neck; one row of yellow gular spots; no postocular band.

*N. c. compressicauda*.

Scales in twenty-three rows; yellowish, with narrow brown cross-bands; one yellow gular band; no postocular band..... *N. c. walkerii*.

**Natrix compressicauda compressicauda** Kenn.

Cope, Proc. U. S. Nat. Mus., 1888, p. 392.

*Nerodia compressicauda* Kenn, Proc. Acad. Phila., 1860, p. 335.

**Florida.****Natrix compressicauda bivittata** Cope.

Proc. U. S. Nat. Mus. 1888, p. 392; Pl. xxvi, Fig. 4.

**Florida.****Natrix compressicauda walkerii** Yarrow.

*Tropidonotus walkerii* Yarrow, Proc. U. S. Nat. Mus., 1883; p. 154.

The scuta of this subspecies are quite as in the last, as in the form of the rostral internasal and frontal plates and the relation of the orbit to the superior labials. Its chief peculiarities are in its twenty-three rows of dorsal scales and in its coloration. In the latter it approaches the *N. c. compsolæma*. Color above, brownish yellow, crossed by numerous brown cross-bars, which are as wide as the spaces which separate them, viz, two scales, and which extend to the first row of scales. These bars become wide on the part of the body near the head, and are split by the ground color without forming bands, except short ones, which form a V on the parietal plates. No postorbital band. Labials dusky, yellow-bordered front; genials the same, with a large medium yellow spot on each. Abdomen dusky, with a median row of round yellow spots, which soon become irregular in number and posi-

tion. Ends of gastrosteges yellow on the anterior fifth of the length. 10681: 137+1+1; 467<sup>mm</sup>, ♀, (tail injured).

Catalogue No.	No. of specimen.	Locality.	From whom received.	Nature of specimen.
10681	1	Clearwater, Fla.....	S. T. Walker.....	Alcoholic.

***Natrix compressicauda compsolema* Cope.**

*Tropidonotus comsolamus* Cope, Proc. Acad. Phila., 1860, p. 368; Check List N. Am. Batr. Rept., 1875, p. 42.

Key West, Florida.

***Natrix valida* Kennicott.**

*Regina valida* Kenn., Proc. Acad. Phila., 1860, p. 334.

Scales in twenty-one rows, the inferior smooth. Head distinct from body, elongate and tapering to the muzzle. Internasals longer than wide; rostral elevated. Oculars 2-3 and 1-3; temporals 1-2. Superior labials eight, eye over fourth and fifth. Tail not compressed at base. Gray or brown, with more or less distinct small spots on the sides. Belly not spotted.

There are two subspecies of the *Natrix valida*, as follows:

Spots small, no bands; belly pale.....*N. v. valida*.

Lateral spots large; a vertebral dark, and lateral light bands; belly dark...*N. v. celæno*.

***Natrix valida valida* Kenn.**

*Regina valida* Kenn., Proc. Acad. Phila., 1860, p. 334.

*Tropidonotus validus* Cope, Proc. Acad. Phila., 1866, p. 310; Check List Batr. Rept.

N. Amer., 1875, p. 42, Geol. Surv., W. 100th mer., 1875, p. 612, Pl. XXI.

*Tropidonotus tephropleura* Cope, Proc. Acad. Phila., 1860, p. 341.

Lower California, Sonora.

***Natrix valida celæno* Cope.**

*Tropidonotus celæno* Cope, Proc. Acad. Phila., 1860, p. 341; *Tropidonotus validus celæno*

Cope, Check List N. Am. Batr. Rept., 1875, p. 42.

Lower California.

***Natrix bisecta* Cope.**

*Tropidonotus bisectus* Cope, Proc. U. S. Nat. Mus. 1887, p. 146.

Washington, District of Columbia. But one specimen known.

***Natrix fasciata* Linn.**

Cope, Proc. U. S. Nat. Mus. 1888, p. 392; *Coluber fasciatus* plus *C. sipedon* Linn., Syst. Nat. 1, 1766, pp. 378-379; *Tropidonotus fasciatus* Dum. Bibr., Erp. Gen., VII, 1854, p. 566; Günther, Cat. Col. Snakes Brit. Mus., 1858, p. 76.

*Tropidonotus sipedon* Cope, Check List Batr. Rept. N. Am., 1875, p. 42.

Scales in twenty-three or twenty-five rows, all keeled; the external larger than the others. Eight superior labials, center of eye over

suture between the fourth and fifth. Orbitals 1-3; temporals 1, 2 or 3. Rostral plate not much elevated; internasal scuta each longer than wide; frontal plate rather narrow; parietal plates each as long as frontal and prefrontal plates together. Pre and postgenials subequal.

General color above from bright reddish brown to gray, marked by large dark brown transverse spots variously arranged, or immaculate. Below yellowish or reddish with or without chestnut or reddish brown spots which are not tessellated, but are more or less rounded. Length about a meter.

This abundant and widely distributed species presents several well-marked varieties which have been described as species. These generally have a definable geographical range. Together they occupy the entire Eastern and Austroriparian regions.

Belly spotted; back with broad transverse spots on a light ground; head pale, with a dark postocular band.....*N. f. fasciata*.  
Belly spotted; back with brown spots which extend to the sides anteriorly only, but which mostly alternate with lateral spots; no postocular band.....*N. f. sipedon*.  
Belly spotted; dorsal bands transverse anteriorly; posteriorly wanting, and lateral spots only.....*N. f. pleuralis*.  
Belly unspotted; dorsal and lateral spots alternate to the head.....*N. f. transversa*.  
Belly unspotted; neither dorsal nor lateral spots.....*N. f. erythrogaster*.

These subspecies belong to the Austroriparian region except *N. f. sipedon*, which is nearly confined to the Eastern, and *N. f. transversa*, which belongs to the Texan district.

#### ***Natrix fasciata fasciata* Linn.**

Cope, Proc. U. S. Nat. Mus. 1888, p. 392.

*Coluber fasciatus* Linn., Syst. Nat. i, 1766, p. 378; 1788, p. 1094; Holbrook, N. Amer. Herp. i, 1838, p. 93, Pl. xx.

*Tropidonotus fasciatus* Holbrook, N. Amer. Herp. 2 ed. iii, 1842, p. 25, Pl. v; Dekay, New York Fauna Rept., p. 47, 1842; do. var. A Günther, Cat. Col. Snakes, Brit. Mus. 1858, p. 76; Cope, Check List Batr. Rept. N. Amer., 1875, p. 42.

*Nerodia fasciata* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 39.

*Coluber porcatus* Latreille Hist. Nat. des. Rept. iv, 1882, p. 32, Pl. —, Fig. 1; Daudin Hist. Nat. Rept. vi, 1803, p. 204; Harlan, Journ. Acad. Phila. 1827, p. 356.

Austroriparian region.

#### ***Natrix fasciata sipedon* Linn.**

*Coluber sipedon* Linn., Syst. Nat. xii, 1766, i, p. 379; Gmel., Linn. Syst. Nat. xiii, i, iii, 1788, 1098; Shaw Gen. Zoöl. iii, pt. ii, 1802, p. 496; Merrem Tentamen, 1820, p. 124; Harlan, Jour. Acad. Phila. 1827, p. 351; Storer, Rept. Mass. 1839, p. 228; Thompson, Hist. Vermont 1842, p. 118.

*Tropidonotus sipedon* Holbrook, N. Amer. Herp. iii, 1842, 29 Pl. vi; Dum. Bibr. Erp. Gen. vii, 1854, p. 568.

*Nerodia sipedon* Bd. and Gird., Catal., 1853, p. 38.

*Tropidonotus sipedon sipedon* Cope, Check List Batr. N. Amer. 1875, p. 42.

*Tropidonotus fasciatus* var. B. Günther, Cat. Col. Snakes Brit. Mus. 1858, p. 75.

*Coluber pacilogaster* Wied, Reise nach N. Amerika i, 1839, p. 106.

Eastern region.

There is considerable doubt whether this subspecies enters the Austroriparian fauna. If so, it appears sparingly, and only on the northern borders. Specimen No. 9008, from Montgomery, Alabama, might be almost as well placed with the *N. f. transversa*, as the belly is unspotted, but the anterior half of the body is cross-banded, as in the *N. f. fasciata*.

*Natrix fasciata pleuralis* Cope.

Scutellation as in the species generally; scales in twenty-three rows, the inferior more weakly keeled and of larger size than the others. Internasals longer than wide; oculars 1-3; middle of orbit above suture between fourth and fifth superior labials.

The color characters are quite peculiar. On the anterior part of the body brown bands cross the ground color reaching to the gastrosteges, the lateral parts having parallel sides, and being separated by spaces wider than themselves. The dorsal parts of these cross-bands gradually disappear, and posterior to the middle or last third of the length are wanting, so that the coloration consists of lateral erect parallelogrammic spots separated by spaces of a yellow or gray ground color equal to or a little wider than themselves. Belly yellow, with brown rounded spots on the anterior parts of the gastrosteges; spots few on the anterior third in the type. Head brown without markings; labials lighter.

1092; 131+1+30†; 23; 517<sup>mm</sup>., 120† (†injured).

8786; 144+1+73; 23.

8786; 136+1+2; 23; 1087 to anus; tail injured.

This form is Austroriparian, but seems to be rare, as but three specimens have come under my observation. They approach the forms of *N. f. sipedon* with lateral spots well separated.

The large specimen in No. 8766 referred to this subspecies is so dark colored that the pattern is only made out when immersed in fluid. The belly also is marked by a narrow transverse blotches on the external parts of the gastrosteges, which afterwards blend and involve the whole surface.

*Natrix fasciata pleuralis* Cope.

Catalogue No.	No. of spec. mens.	Locality.	From whom received.	Nature of specimen.
1092	1	Mississippi	(†)	Alcoholic.
8786	2	Augusta, Ga.	Wm. Phillips	Do.

*Natrix fasciata transversa* Hallow.

*Tropidonotus transversus* Hallow., Proc. Acad. Phila., 1852, p. 177.

*Nerodia transversa* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 148.

*Nerodia woodhousei* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 42; Rept. U. S. Pac. R. R. Surv., x, 1859, Whipple's Rept., 41.

*Tropidonotus woodhousei* Jan, Icon. Gen. Ofid., II, 26, IV, Fig. 1.

Texan district.

**Natrix fasciata erythrogaster** Shaw.

Cope, Proc. U. S. Nat. Mus., 1888, p. 392.

*Coluber erythrogaster* Shaw, Gen. Zool., III, 1802, p. 458; Holbrook, N. Amer. Herp., II, 1838, p. 91, Pl. XIX.

*Tropidonotus erythrogaster* Holbr., N. Amer. Herp., 2d ed., III, 1842, p. 33, Pl. VIII; Dum. Bibr. Erp. Gen., VII, 1854, p. 570.

*Nerodia erythrogaster* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 40.

*Tropidonotus sipedon erythrogaster* Cope, Check List Batr. Rept. N. Amer., 1875.

Austroriparian region, entering rarely the eastern.

**Natrix rhombifera** Hallow.

*Tropidonotus rhombifer* Hallowell, Proc. Acad. Phila., 1852, p. 177; Cope, Check List N. Amer. Batr. Rept. 1875, p. 43; *Nerodia rhombifer* Bd. and Gird., Cat. Rept. Serpt., 1853, p. 147; *Nerodia holbrookii* Bd. and Gird., l. c., p. 43.

*Tropidonotus pogonias* Dum. Bibr., Erp. Gen., 1854, p. 574.

*Tropidonotus fasciatus* var. *pogonias* Jan, Icon. Gen. Ofid. II, 26, III, Fig. 1.

*Tropidonotus cyclopium* Jan, Icon. Gen. Ofid. II, 26, VI Fig. 1, not of D. and B.

In thirteen specimens in which I counted the rows of scales, I found but one in which the number is not twenty-seven; this was in No. 10759, a small and starved individual, which has twenty-five rows. In dimensions this water snake rather exceeds the *N. s. fasciatus*, and is only exceeded in our fauna by the *N. taxispilota*.

The Lower Mississippi is the headquarters of this species, where it is very abundant. It is not yet known from east of that river, but ranges north to the limits of the Regio Austroriparia, to southern Illinois, and west throughout Texas. It is the only one of our water snakes which extends to the Tierra Caliente of Mexico, having been brought by the Commission Exploradora from Misantla, in the State of Vera Cruz.

**Natrix cyclopium** Dum. Bibron.

*Tropidonotus cyclopium* Duméril & Bibron, Erpetologie Générale VII, p. 576; Günther, Cat. Col. Snakes Brit. Mus., 1858, p. 77; Cope, Proc. Acad. Phila., 1861, p. 299; Check List N. Amer. Batr. Rept., 1875, p. 43.

This well-marked species is much less abundant than its allies the *N. rhombifera* and *N. taxispilota*. The few specimens in the National Museum collection come from the three extreme points of the Austroriparian district, viz, Florida, New Orleans, and south Illinois.

The *N. cyclopium* is nearest the *N. rhombifer*. The pattern of coloration is quite different; and the scutellation also differs in several important respects. In the *N. cyclopium* the nasal plates are shorter anteroposteriorly, and there are only two scuta which are properly postocular. The posterior temporals are smoother, and not keeled, and the body scales are emarginate, which they are not in the *N. rhombifera*.

The possession of a series of scales below the orbit, while present in all known specimens of this species, is not confined to it. I have seen it in a specimen of the *N. taxispilota*, and it is found in the only known specimen of the *Natrix anoscopus*\* Cope, from Cuba.

\* *Tropidonotus anoscopus* Cope, Proc. Acad. Phila., 1861, p. 299.  
Proc. N. M. 91—43

**Natrix taxispilota** Holbrook.

Cope, Proc. U. S. Nat. Mus., 1888, p. 392.

*Tropidonotus taxispilotus* Holbrook, N. Amer. Herpet., IV, 1843; p. 35, Pl. 8, Dum. Bibr., Erp. Gen. VII, 1854, p. 605; Jan, Icon. Gen. Ofid., II, 26, v. Fig. 1.

*Tropidonotus taxispilotus* ? var *Brocki* Heilprin, Transac. Wagner Free Inst. Science I, 1887, 129, Pl. 17.

This is the largest American water snake. Its range is limited, extending in the Austroriparian region from the Potomac River to New Orleans and to Florida, inclusive.

**CLONOPHIS** Cope.

Proc. U. S. Nat. Mus., 1888, p. 391; Cope Jan, Elenco Sist. 1863, p. 74, not of Selys, 1853, nor Bonap., 1854.

Teeth of equal length. Head not distinct from body. Scales keeled; anal scutum and subcaudal scuta divided. Cephalic plates normal; two internasals, rostral not prominent. One nasal, one loreal, and one preocular.

But one species of this genus is known. I formerly placed it in *Tropidoclonium*, but that form has an undivided anal plate. Both are burrowing snakes of affinities to the water snakes.

**Clonophis kirtlandii** Kenn.

Cope, Proc. U. S. Nat. Mus., 1888, p. 391; *Regina kirtlandii* Kennicott, 1856, p. 95; *Tropidoclonium kirtlandii* Cope, Proc. Acad. Phila., 1860, p. 340; Check List Batr. Rept. N. Amer., 1875, p. 42. *Ischnognathus kirtlandii* Jan, Icon. Gen. Ofid. II, 30, Fig. 1.

This species has a limited range; it has been recorded so far from northern Illinois and Michigan only.

**STORERIA** Bd. and Gird.

Cat. Rept. N. Amer., Pt. I, Serpt., 1853, p. 135. *Ischnognathus* Duméril, Prodrôme des Ophidiens, 1853, p. 72; Dum. Bibron, Erp. Gen. VII, 1854, p. 506.

Head distinct from the body. Cephalic plates normal. Loral plate absent. Orbitals, posterior and anterior. Nasals, two. Body subcylindrical; tail comparatively short, tapering. Dorsal scales carinated. Anal scutum bifid. Subcaudals divided. Teeth small, numerous, of equal lengths, none grooved.

This genus is a reduced type of *Natrix*, to which it is connected by the Mexican *N. storeriodes* Cope. Its range is Nearctic, extending south as far as the plateau of Vera Paz and Guatemala.

There are three species of the genus, which differ as follows:

Oculars 1-2, seven upper labials, the posterior wide; nostril between nasals; belly grayish white; a black spot below orbit.....*S. dekayi*.  
Oculars 1-2; six upper labials, the posterior narrow; nostril between nasals; no black spot below orbit; belly grayish white.....*S. tropica*.  
Oculars 2-2; five or six upper labials, the posterior narrow; nostril in anterior nasal; a dark spot below orbit; belly red.....*S. occipitomaculata*.

\* *STORERIA TROPICA* Cope, Proc., Amer. Philos. Soc., 1884, p. 175; Guatemala.

**Storeria dekayi** Holbrook.

Bd. and Gird., Cat. Rept. N. Amer., Pt. 1, Serpents, 1853, p. 135; Cope, Check List N. Amer. Rept. Batr., 1875, p. 42.

*Tropidonotus dekayi* Holbrook, N. Amer. Herpet., III, 1842, p. 53, Pl. XIV; Dekay, New York Fauna Rept., 1842, p. 46; *Ischnognathus dekayi* Dum., Bibr. Erp. Gen., VII, 1854, p. 507; Günther, Catal. Col. Snakes Brit. Mus., 1858, p. 81; Jan, Icon. Gen. Ofid., II, p. 30, Figs. 3, 4; *Tropidonotus ordinatus* Storer, Rept. Mass., 1839, 223.

United States, exclusive of Pacific region; Mexico.

**Storeria occipitomaculata** Storer.

Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 137; Cope, Check List Batr., Rept. N. Amer., 1875, p. 42; *Tropidonotus occipitomaculatus* Storer, Rep. Rept. Mass., 1839, p. 230; *Ischnognathus occipitomaculatus* Günther, Cat. Colubr. Snakes Brit. Mus., 1858, p. 81; Jan, Icon. Gen. Ofid., II, p. 30, Fig. 2; *Coluber venustus* Hallow., Proc. Acad. Phila., 1847, III, p. 274; loc. cit., IV, 1849, p. 245.

United States, exclusive of Pacific region; Mexico.

**AMPHIARDIS** Cope.

Proc. U. S. Nat. Mus., 1888, p. 391.

Head not distinct; teeth equal. Scales keeled; anal and subcaudal scuta divided. Cephalic scuta of upper surface normal. Rostral not prominent; two internasals. Two nasals; one loreal, which extends to the orbit. No preocular. Pupil round.

This genus embraces as yet but a single species. It is most nearly allied to *Haldea*, from which it differs only in the presence of two internasal plates. The species is little known.

**Amphiardis inornatus** Garman.

Cope, Proc. U. S. Nat. Mus., 1888, p. 391; *Virginia inornata* Garman, Mem. Mus. Comp. Zool. Camb., VIII, 1883, p. 97.

From near Dallas, Tex.

**HALDEA** Bd. and Gird.

Cat. Rep. N. Amer. Serpents, 1853, p. 122; *Conocephalus* Duméril, Prodrome des Ophiidiens, p. 46, 1853; *Falconeria* Theobald, teste Boulanger.

Head elongated, ellipsoid, distinct from the body. Internasal plate single. Prefrontals large, entering together with the loreal into the orbit, thus suppressing the anteorbitals. Postorbital one. Two nasals. Pupil circular. Scales carinated. Postabdominal scutella bifid. Subcaudals divided.

This genus has the form and probably the habits of the Calamarinæ, but the continuity of the vertebral hypapophyses throughout the vertebral column indicates that its affinities are with the Natricinæ, of which group it is probably a degenerate offshoot.



*Haldea striatula* Linn.

Bd. and Gird., Cat. 1853, 122; Cope, Check List Batr. Rept. N. Amer., 1875, p. 35; *Coluber striatulus* Linn., Syst. Nat., i, 1766, p. 375; Gm. Linn. Syst. Nat., Ed. xiii. 1788, 1887; Harlan, Journ. Acad., Phila., v, 1827, p. 354; *Calamaria striatula* Schleg. Ess. s. Physion. Serpt., 1837, p. 43; Holbrook, N. Amer. Herp., iii, 1842, 123, Pl. xxix; *Conocephalus striatulus* Dum. Bibr., vii, 1854, p. 140; Jan, Icon. Gen. Ofid., i, p. 12, iii, Fig. 1.

North America; Austroriparian region.

**ERYTHROLAMPRUS** Boie.

Isis von Oken, 1826, p. 981; Cope, Bull. U. S. Nat. Mus. 32, 1887, p. 55; *Coniophanes* Hallow., Proc. Acad. Phila., 1860, p. 484; Cope, loc. cit., 1860, p. 248; *Glaphyrophis* Jan, Elenco List. Ophid. 1863, p. 54.

Posterior maxillary teeth elongate, grooved. Cephalic shields normal; two nasals, loreal present. Scales smooth, without fossa. Anal and subcaudal scuta divided. Pupil round.

The type of this genus is found throughout tropical America (*E. venustissimus* L.), and a second (*E. dromiciformis* Pet.), is found on the Pacific slope of the Andes near the equator. The remaining nine species belong to Central America and Mexico, and one of them has been taken in the United States on the lower Rio Grande. The typical species is red with black annuli in coloration, while most of the remainder are striped. The transition is effected by the *E. lateritius* Cope, which is a red species with black head and neck. The only species which enters our limits is characterized as follows:

Scales in nineteen rows; superior labials eight; one preocular; light brown with blackish sides and dorsal stripe; below red, unspotted..... *E. imperialis*.

**Erythrolamprus imperialis** Bd. and Gird.

Cope, Bull. U. S. Nat. Mus. 32, 1887, p. 77; *Toniophis imperialis* Bd. and Gird., U. S. Mex. Bound. Surv., ii, 1859, 23, Pl. xix, Fig. 1; *Coniophanes imperialis* Cope, Proc. Acad. Phila., 1861, p. 74; *Tachymenis imperialis* Garman, Mem. Mus. Comp. Zool. Cambr., viii, 1883, p. 154.

Besides Cameron County, southwest Texas, this species has been found near Tuxpan by Linneum, and at Jicaltepec, Vera Cruz, by the Comisión Geográfica de Mexico.

**SIBON** Fitzinger.

Neue Class. d. Reptilien, 1826, p. 29. *Heterurus* Dum. Bibr., Erp. Gen., vii, 1854, p. 1170. *Leptodira* Günther, Cat. Col. Snakes, Brit. Mus., 1858, p. 165 (e nom. nud. Fitzingerii, 1843). *Eteirodipsas* Jan, Elenco Sist. d. Ofidi, 1863, p. 105.

An elongate grooved tooth on the posterior part of the maxillary bone; other teeth subequal. Head plates normal; one loreal. Preanal and subcaudal scuta double; scales smooth, with two apical pits. Pupil vertical.

This genus has near allies among the Dipsadine group, to which it belongs. From *Dipsas* it is distinguished by the divided preanal plate; from *Himantodes* \* by the double scale-pits, that genus having but one. From *Trimorphodon* it differs in the equality of the ungrooved maxillary teeth and the single loreal plate. The greater number of species of this genus are Mexican and Central American, one species (*S. annulatum*) extending its range throughout tropical South America. One species only has been found on the Rio Grande River, and extends within our borders. The species are closely allied and are subject to some variation. One only (*S. rhombiferum* Gthr.) I have not seen, and I give its characters on the authority of Günther. All the species known have but one temporal plate in the first row. The species differ as follows:

I. Superior labials eight to nine.

a Scales in 21-5 rows.

Body slender, compressed; scales in twenty-one rows; preoculars two; dorsal spots small, no postocular band ..... *S. annulatum* † L.

Body robust, cylindric; scales in twenty-one rows; preoculars two; dorsal spots large, wide; a conspicuous black postorbital band.

*S. yucatanense* † Cope.

Robust; scales 23-5 rows; preoculars three; conspicuous dorsal spots, and postorbital band. .... *S. septentrionale* Kenn.

Robust; scales twenty-one; one preocular; numerous transverse black dorsal rhombs, and no lateral spots; top and sides of head black.

*S. personatum* § Cope.

Robust; scales twenty-five; loreal longer than deep; brown with yellow cross-bars and black-edged brown dorsal rhombs. . . . *S. rhombiferum* ‖ Gthr.

Robust; scales twenty-three; preoculars two; loreal square; black with narrow gray cross-bands; a conspicuous postocular band; labials nine.

*S. frenatum* ¶ Cope.

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\* *Himantodes* Dum., Bibr. Erp. Gen., VII, 1854, p. 1064. The four species of this genus may be distinguished as follows:

1. Two temporal plates in anterior row.

A row of large vertebral scales; very slender; tail one-third. .... *H. cenchoa* L.

A larger vertebral row; less slender; tail three and one-third times in length.

*H. leucomelas* Cope.

No larger vertebral row; dorsal spots to gastrosteges; slender.

*H. tenuissimus* Cope.

2. One temporal scale of first row.

No large vertebral row; less slender. .... *H. gemmistratus* Cope.

*H. cenchoa* is South American and extends north to Vera Cruz; the other species are Central American and Mexican.

† *Leptodira annulata* Gthr., *Dipsas annulata*, D. and B.; South America, Panama, Costa Rica.

‡ *Sibon annulatum yucatanense* Cope, *Proceeds. Acad. Phila.*, 1866, p. 127; Yucatan, Belize.

§ *Leptodira personata* Cope, *Proc. Acad. Phila.*, 1868, 310, Mazatlan, Mexico.

‖ *Leptodira rhombifera* Günther, *Ann. Magaz. Nat. Hist.*, 1872, 32.

¶ *Proc. U. S. Nat. Mus.*, 1886, p. 184. Jalapa, Mex.

$\alpha\alpha$  Scales in nineteen rows.

Robust; preoculars two; loreal short; parietal quite or nearly touching postocular; cross-bands much wider than interspaces; a postocular stripe.

*S. nigrofasciatum* \* Gthr.

## II. Superior labials seven.

Robust; scales nineteen rows; preoculars two; pale brown, with several rows of small blackish spots; a blackish half collar above; head paler; no postocular band ..... *S. pacificum* † Cope.

### **Sibon septentrionale Kennicott.**

*Dipsas septentrionalis* Kennicott, U. S. Mex. Bound. Surv., Reptiles by Baird, II, p. 16, Pl. 8, Fig. 1. *Sibon annulatum septentrionale* Cope, Check List Batr. Rept. N. Amer., 1875, 38; Catal. Batr. Rept. Centr. Amer. Mex., 1887, 67.

The largest species of the genus, ranging from Panama to Cameron County, Texas, inclusive.

### **TRIMORPHODON Cope.**

Proc. Acad. Phila., 1861, p. 297; Bull. U. S. Nat. Mus. 32, 1897, p. 68.

Posterior maxillary tooth elongate, grooved; anterior teeth of both jaws elongate; intermediate teeth of the maxillary series, shorter. Head plates normal; two nasals; two loreals, one in front of the other. Pupil vertical. Head very distinct. Scales smooth, subequal. Anal scutum divided; subcaudal scuta in two series.

This genus includes species which inhabit Central America, Mexico, and the adjacent parts of the United States. It is allied to *Sibon*, from which the elongate anterior teeth and the two loreal scuta distinguish it. No species of *Sibon* is known to possess two loreals, one anterior to the other. The species of *Trimorphodon*, with their wide triangular head, narrow neck, and slitlike pupil, considerably resemble venomous snakes, which their pugnacious disposition does not diminish. They differ as follows:

#### I. Scales in twenty-one rows; superior labials nine.

Head with brown chevrons above; nape with a brown collar; back with diamond-shaped spots ..... *T. lambda* Cope.

Head with a lyre-shaped pattern above, nape with parallel stripes; dorsal spots in pairs ..... *T. lyrophanes* Cope.

#### II. Scales in twenty-three rows; superior labials seven.

Top of head black with a white T-shaped spot; dorsal spots entire transverse diamonds ..... *T. tau* Cope.

#### III. Scales in twenty-three (4) rows; superior labials eight.

Top of head brown, with a small V-shaped mark; dorsal spots transverse diamonds, more or less transversely divided by paler; nape with a brown collar ..... *T. epsilon* Cope.

\* *Leptodira nigrofasciata* Gthr., Ann. Magaz. Nat. Hist., 1868, 425. *L. mystacina* Cope, Proc. Amer. Philos. Soc., 1869, p. 151. Dr. Günther describes a specimen in which the inferior preocular is abnormally absent or he has overlooked it, and the inferior postocular is wanting. My type is abnormal in lacking a labial, and in having a temporal in excess. My specimens, five in number (mostly normal), are from the west coast of Mexico (Tehuantepec) and Central America.

† *Leptodira pacifica* Cope, Proc. Acad. Phila., 1868, 360; Mazatlan, Mexico.

## IV. Scales in twenty-three (4) rows; superior labials nine.

Top of head brown; dorsal spots numerous, transverse, more or less divided diamonds ..... *T. collaris* Cope.\*

Top of head white, with three round black spots; dorsal spots few transverse undivided black rhombs, with pale edges ..... *T. wilkinsonii* Cope.

## V. Scales in twenty-five (7) rows; superior labials nine.

Top of head with chevron bands; dorsal spots formed of four confluent spots and inclosing a pale center ..... *T. biscutatus* Dum. Bibr.

Of the preceding species I have before me one each of the *T. lambda*, *tau*, *collaris*, and *wilkinsonii*. Of the *T. lyrophanes* there are six specimens; of the *T. upsilon* six, and of the *T. biscutatus*, four.

The type of the genus is the *T. lyrophanes*. It is the only species found within the limits of the United States.

***Trimorphodon lyrophanes* Cope.**

Proc. Acad. Phila., 1861, p. 297; Proc. Amer. Philos. Soc., 1885, p. 286; *Lycodon lyrophanes* Cope, Proc. Acad. Phila. 1860, p. 343; *Sibon biscutatum* Garman, Mem. Mus. Comp. Zool. Cambr., VIII, 1883, p. 134.

Arizona; Lower California.

**III.—PROTEROGLYPHA.****ELAPIDÆ.****ELAPS Schneider.**

Historia Amphib., 1801, II, p. 289; Dum. Bibr., Erp. Gen., VII, 1854, 1191; Günther, Cat. Snakes Brit. Mus., 1858, 229; Cope, Bull. U. S. Nat. Mus., 32, 1887, p. 62.

Maxillary bone without solid teeth behind the perforated tooth. Cephalic plates normal; rostral not modified. Two nasal plates; no loreal; oculars few. Scales not keeled, without fossa. Subcaudal scutella in two rows; anal plate divided. Pupil a vertical oval. Head little distinct.

This genus embraces twenty or more species of the Neotropical realm, three of which have their principal habitat in the southern portions of the Nearctic. They are of rather elongate body and short tail, and have small eyes. They approximate in general appearance the Calamarine Colubridæ, so that their discrimination, except on examination of the dentition, from snakes of this group, can only be accomplished by experts in species characters. The scutellation of the head is exactly that of the genus *Tantilla*. The coloration is brilliant, consisting of red and black, with less yellow, arranged in rings or parts of rings. The red is generally the ground color, and the black rings are either single, or in sets of three. The latter may be much narrower than the ground color, or may be so wide as to reduce it to very small proportions (*E. semipartitus*, *E. imperator*). The epidermis is beautifully iridescent, especially on the black spaces. The colors are much like those of the mineral labradorite, and are probably due to a similar physical cause, viz,

\**Eteirodipsas biscutata* Jan, Icon. Gen. Ofid., II, 39, Fig. 3 (not *T. biscutatus* D. & B.).

a microscopic lamination of the surface. On direct and antero-posterior views the color is peacock purple; on transverse views it passes from brassy yellow through brassy green to maroon and brown. The colors do not appear if the scales are wet.

The bite of some of the larger species, as *E. surinamensis* and *E. macrogravi*, is said to be dangerous, but that of the smaller ones is innocuous to man and the larger animals.

Three species are found within the limits of the Nearctic realm, which differ as follows:

I. Temporal scales 1-1; a black ring immediately behind head; internasals much smaller than prefrontals.

Tail one-seventh to one-eighth total length; black rings wide, covering from seven to ten scales; red spaces above and below black spotted; three or four black rings on tail; muzzle and chin black.....*E. fulvius*.

Tail one-seventh total length; black rings narrow, covering two to three scales; red spaces above and below not black spotted; tail with seven black rings; nose and chin red.....*E. distans*.

II. Temporal scales 1-2; internasals equal or nearly equal prefrontals; a red ring immediately behind head.

Tail very short, one-fourteenth total length; black rings six or seven scales wide, with very wide yellow borders; interspaces above and below unspotted; tail with two black rings; nose and chin black...*E. eryzanthus*.

#### *Elaps fulvius* Linn.

Cuv., Regn. Anim., II, 1817; Fitz. N. Class. Rept., 1836, 61; Holbr., N. Amer. Herp., II, 1838, 87, Pl. XVIII, and 2d, III, 1842, 49, Pl. X; Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 21; Duméril and Bibron, Erp. Gen., VII, 1854, p. 1215; Günther, Cat. Colubr. Snakes Brit. Mus., 1858, p. 235; Cope, Check List Batr. Rept. N. Amer., 1875, p. 34; Jan, Icon. Gen. Ofid., II, 421, Fig. 2.

*Coluber fulvius*, Linn., Syst. Nat., I, 1766, 381; Gm., Linn., Syst. Nat., ed. XIII, I, III, 1788, 1104.

*Vipera fulvia* Harl., Journ. Acad. Nat. Sci. Phila., v, 1827, 364.

*Elaps tener* Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 22; *E. tristis* Bd. and Gird., loc. cit., p. 23.

#### Austroriparian region.

Specimens from western Texas (Indianola, on the Gulf of Mexico, and the Pecos River, in the north) differ somewhat from those from farther east, and furnish the basis for the supposed species *E. tener* Bd. and Gird. Generally the frontal plate is not wider than the superciliary, but in one specimen it is as wide as in the typical form (No. 8574). The red spaces are more closely spotted and blotched with black, the blotch on the belly being especially large. The yellow borders are also wider, covering two and one and a half rows of scales, while those of the typical *E. fulvius* cover but one. A specimen from New Orleans is intermediate in these points of coloration (No. 4804), and in specimens from Pensacola (8783) and St. Johns River (8230), Florida, the yellow borders are one and a half and even two scales wide. I do not find the Texas forms to represent a subspecies.

The number of black rings on the body and tail varies within rather narrow limits. I give the following account of them as they occur on

sixteen specimens. The first number represents those on the body; the second that on the tail.

11-3, 8574; 12-3, 6045, 6081, 1137; 12-4, 1135, 4804, 8230; 13-3, 7776; 13-4, 8783; 14-4, 1142, 4716; 15-4, 1120, 10606, 10674; 16-4, 9933; 17-4, 8813. In coloration the *Elaps fulvius* represents the type with single rings in approximation to that with triple rings, since the black spots of the ground are most dense next the yellow borders, thus foreshadowing narrow rings at these points, such as exist in the *Elaps lemniscatus*.

The *Elaps fulvius* ranges from North Carolina (exclusive) to the Tierra Templada of the State of Vera Cruz, Mexico. A specimen is in the National Museum from Jalapa.

*Elaps distans* Kennicott.

Proc. Acad. Phila., 1860, p. 334; Cope, Check List N. Amer. Batr. Rept., 1875, p. 34. Florida.

The characters which distinguish this species from the *Elaps fulvius* are those of color only, as in structural characters the two are identical. Many of the species of the genus differ in such characters only, and they are often very constant. The present species displays equal constancy in the known individuals.

The specimen alleged by Dr. Yarrow (Check List, p. 82) to have been sent from Chihuahua, Mexico, belongs to the *E. euryxanthus*. *E. distans* has been found only in Florida.

*Elaps euryxanthus* Kennicott.

Proc. Acad. Phila., 1860, p. 337; Cope, Check List N. Amer. Batr., 1875, p. 34.

The proportions of the head plates in this species are very different from what is observed in *E. fulvius* and other species, and mark it as one of the most distinct species of the genus. Its geographic range is the Sonoran region, beyond which it has not been found.

Prof. F. Cragin, of Topeka, Kans., sent me a specimen of this species which he obtained at Guaymas, on the Gulf of California. The specimen (1123) from the Rio Grande River, referred to this species by Yarrow (Check List, p. 82), belongs to the *E. fulvius*.

#### IV.—SOLENOGLYPHA.

##### UROTALIDÆ.

*ANCISTRODON* Beauvois.

Trans. Amer. Philosophical Society, iv, 1799, p. 381; Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 17; Cope Bull. U. S. Nat. Mus. 62, 1887, p. 63.

*Cenochris* Daudin, Hist. Nat. Reptiles, v, 358, 1803; Wagler Nat. Syst. Amphib., 1830, p. 175.

*Toxicophis* Troost, Amer. Lyc. Nat. Hist. N. York, III, 1833, 190; Bd. and Gird., Cat. Serpt. N. Amer., 1853, p. 19.

Nine symmetrical plates on top of the head, the superciliary bounding the orbit above. Nasal plates two. Scales keeled, bifossate. Anal

plate and caudal scuta undivided. No rattle. Body and tail cylindrical.

Three species of this genus are known, two of which belong to the Nearctic, and one to the northern part of the Neotropical Realm. They are snakes of robust habit, and their bite is highly dangerous. One is terrestrial in habit, and the other semiaquatic. They differ as follows:

I. No loreal; two small plates behind the parietals; eye resting on labials.

Scales in twenty-five rows; brown with broad blackish-brown cross bands with zigzag borders, and the lateral centers pale and with a median dark spot; a light stripe from superciliary plate and one from below eye, which reaches labial border of last upper labial ..... *A. piscivorus*.

II. Loreal present; plates behind parietal rudimental; eye separated from labials by scales.

Scales in twenty-five rows; dark grayish with brown crossbands, wide on the middle line, and with imperfect yellow borders; belly black, with transverse yellow spots on the sides; a yellow stripe from end of muzzle and superciliary plate; other yellow stripes on borders of rostral plate and through centers of superior labials ..... *A. bilineatus*.\*

Scales in twenty-three rows; grayish with copper-colored cross bands, much narrowed on the middle line, and with pale centers laterally; no stripes on head, but a color border from middle of orbit to top of last upper labial; belly whitish, with black spots on sides ..... *A. contortrix*.

Baird and Girard have proposed to separate the *A. piscivorus* as type of a genus *Toxicophis*, on account of the presence of a pair of postparietal scuta and the absence of loreal. The *A. bilineatus* is, however, intermediate between that species and the *A. piscivorus* in having traces of the postparietals and a loreal plate.

Several characters are common to the species of *Ancistrodon* which are also found in other genera of *Crotalidæ*. As in all genera with scuta on the top of the head, the superior plane of the muzzle makes a right angle with the sides, forming a strong canthus rostralis, which is continued round the apex of the rostral plate. The fossæ of the epidermal scales are situated farther back than in the genera of the harmless snakes, and a small tuberosity of the true scale fits into each of them. There are frequently several divided urosteges near the end of the tail, but their number is irregular, and they are sometimes absent, as in *Ancistrodon contortrix* No. 10361. The last of the caudal vertebræ consists of an osseous splint with acute apex, which is ensheathed in three modified scales, two above and one below, which is better developed than in most harmless snakes. This process is thrown into rapid vibration when its possessor is alarmed, and produces a buzzing sound when among dry leaves or other objects. It foreshadows the rattle of the *Crotali*. It is especially developed in the Neotropical genus *Lachesis*. It is variable in size in the *Ancistrodons*.

\**ANCISTRODON BILINEATUS* Günther, Ann. Magas. Nat. Hist. 1863, November. The U. S. National Museum possesses two specimens from Tehuantepec (west side), Mexico, from Francis Sumichrast. The largest is equal to an average sized *Ancistrodon contortrix*.

*Ancistrodon piscivorus* Lacépède.

Cope, Proc. Acad. Phila., 1859, p. 336; Check List Batr. Rept. N. Amer., 1875, p. 34.  
*Crotalus piscivorus* Lacépède, Serpens II, 1787, p. 424.  
*Soytalus piscivorus* Latreille, Hist. Nat. Reptiles III, 1801, p. 163; Daudin Hist. Rept. v, 1803, p. 344; Harlan, Med. Phys. Res., 1835, p. 129.  
*Natrix piscivorus* Merrem, Tentamen, 1820, p. 131.  
*Trigonocephalus piscivorus* Holbrook, N. Amer. Herp. III, 1842, p. 33, Pl. 7; Dum. et Bibron, Erp. Gen. VII, 1854, p. 1492; Jan, Icon. Gen. Ofid. II, 46, IV, Fig. 1-2-4.  
*Toxicophis piscivorus* Bd. and Gird. Cat. 1853, 19.  
*Coluber aquaticus* Shaw, Gen. Zoöl. III, 1802, p. 425, Pl. 3, from Catesby "Water Viper," Carol. II, Pl. 43, 1754.

## The Austroriparian region.

In some specimens from western Texas the superior labial plates have a slight anterior position at the expense of the second, which is somewhat narrowed, especially toward the labial border. In one specimen (No. 822) this plate is a triangle with the apex downward, which does not reach the labial border. In another it enters the border by a narrower edge than in typical forms. The character is thus variable. The same displacement of the labials brings the fourth labial into the border of the orbit by a short edge in some specimens, but this character is also quite inconstant. On such specimens Baird and Girard proposed their *Toxicophis pugnae*, but under the circumstances the form does not seem to be distinguishable.

In the young of the *Ancistrodon piscivorus* the colors are brighter, the colors more contrasted, and the pattern therefore more distinct.

*Ancistrodon contortrix* Linn.

Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 17; Cope Check List Batr. Rept. N. Amer., 1875, p. 34.  
*Boa contortrix* Linn, Syst. Nat., 1766, I, p. 373; do. Syst. Nat. Ed. 13, 1768 I, Pt. III, p. 1082.  
*Ancistrodon mokeson* Pal de Beauvois, Trans. Amer. Philos. Soc. IV, 1799, p. 381.  
*Cenchris mokeson* Daudin, Rept. v, 1803, p. 358, Pl. 40, Fig. 3; Harlan Univ. Phys. Res., 1835, p. 128.  
*Soytalus cupreus* Rafinesque, Amer. Journ. Arts Sci., 1834, I, p. 85; Harlan, p. 130.  
*Trigonocephalus cenchris* Schleg., Ess. s. la Phys. des Serpents, II, 1837, 553, Pl. 20, Figs. 10-11.  
*Trigonocephalus contortrix* Holbrook, N. Amer. Herpetol. III, 1842, p. 39, Pl. 8; Duméril et Bibron Erp., Gen. VII, 1854, p. 1494; Jan, Icon. Gen. Ofid., II, 46, v, Fig. 1.

Eastern and Austroriparian regions; extending eastward to central Massachusetts.

In eleven specimens six have the superior labials 8-8, two have them 7-8, and three have them 7-7. The reduction to seven may be regarded as abnormal, since in that case there is generally irregularity. It arises sometimes from the fusion of the seventh and eighth plates, and sometimes from the exclusion of the sixth or seventh from the labial border by contraction below. In the latter case the plate becomes sub-



triangular, and resembles a temporal. The modification is of the same character as that which sometimes affects the second superior labial in the *A. piscivorus*.

### CROTALOPHORUS Gray.

Ann. Philosophy, 1825, p. 205; Cat. Brit. Mus., 1849, p. 17; Holbrook, N. Amer. Herp., 1842, III, 25; Bd. and Gird., Cat. Serpt., Smiths. Inst., 1853, p. 11; Cope, Bull. U. S. Natl. Mus., 32, 1887, p. 63; Gmelin, Syst. Nat., 1788, I, 1080; Bonuaterre, Ophiologie, 1790, p. 1; Merrem, Tent. Syst. Amphib., 1820, p. 156; Boie, Isis, 1827, p. 562.

*Caudisoma* Fitzinger, Neue Class. Rept., 1826, p. 63 (not of Laurenti, 1764); Wagler, Nat. Syst. Amphib., 1830, 176; Bonaparte, Saggio, 1832, p. 24; Gray, Zool. Mus., 1842, p. 51; Fitzinger, Syst. Rept., 1843, p. 29.

*Sistrurus* Garman, Mem. Mus. Compar. Zöology, Camb. VIII, No. 3, p. 118, 1883.

Tail with a rattle at extremity. Head with nine symmetrical plates above. Nostril between two plates. Urosteges undivided. Scales carinated.

This genus, as is immediately perceived, differs from *Crotalus* only in the possession of the nine cephalic scuta common to most harmless, and the Proteroglyph snakes, and the genera *Trigonocephalus* and *Ancistron* in *Crotalidæ*. The species do not reach so large a size as those of *Crotalus*, and they are hence less dangerous. Their range is also more restricted, since no species is known from South America or Mexico south of Vera Cruz.

Mr. S. W. Garman has named this genus *Sistrurus*, on the ground that the name *Crotalophorus* was preoccupied at the time it was employed by Gray. This does not, however, seem to be the case. It is true that Linnæus uses it instead of *Crotalus* in the sixth edition of the *Systema Naturæ* (1748, p. 33), but the system of nomenclature thus adopted is not binomial, so that the names are not authoritative as against later ones. In case *Crotalophorus* should be adopted from this use of it by Linnæus, it must take precedence of *Crotalus* of the tenth and later editions. In my opinion, however, authors have been justified in regarding it as an unused name until applied to the present genus by Dr. J. E. Gray in 1825.

Three well defined species are known, which differ as follows:

- Rostral plate wider than high, recurved above; canthus rostralis obscure; loreal plate separating nasal and preocular; head not banded; dorsal spots few, longer than wide; rattle medium..... *C. rarus*.\*
- Rostral plate higher than wide, not recurved above; canthus rostralis sharp; loreal separating nasal and preocular; rattle minute; head banded; light stripe, commencing at eye; dorsal spots many..... *C. miliaris*.
- Rostral plate higher than wide, not recurved above; canthus rostralis sharp; nasal and preocular in contact; rattle larger; head banded; light stripe commencing at nasal plate; two light stripes below fossa; dorsal spots many .... *C. ostenatus*

These three species occupy three distinct regions. The *C. rarus* belongs to the Tierra Caliente of eastern Mexico; the *C. miliaris* to the

\*CAUDISONA RAVA Cope, Proc. Acad. Phila., 1865, p. 191. Mexico. The types came from the State of Vera Cruz and belong to the National Museum. A larger specimen in my private collection came from either the State of Vera Cruz or Puebla.

Austroriparian region of North America, and the *C. catenatus* to the Eastern region, except that part of it that lies east of the Allegheny Mountains. The species do not occur on the dry plains of the interior, nor in the Pacific region; a subspecies of the *C. catenatus* ranges west to Arizona.

***Crotalophorus miliaris* Linn.**

Gray, Ann. Philos., 1825, p. 205; in Griff. Règne Anim., 1830, p. 78; Holbrook, N. Am. Herp., 1842, p. 25; Gray, Cat. Brit. Mus., 1849, p. 17; Bd. and Gird., Cat. Serpt., Smiths. Inst., 1853, p. 11; Baird, U. S. Pac. R. R. Expl. Rep., x, 1859. Whipple's Rept., p. 40.

*Crotalus miliaris* Linn., Syst. Nat. Ed., XII, v. 1, 1766, p. 372; Gmelin, Linn., S. N., 1, 1788, p. 1060; Lacépède, Hist. Serp., II, 1789, p. 421; Bonnaterre, Ophiol., 1790, p. 1; Shaw, III, 1802, p. 335; Daudin, Hist. Rept., v, 1802, p. 328; Cuvier Règne Animal, II, 1817, p. 79; Merrem, Syst. Amphib., 1820, p. 156; Boie, Isis, 1827, p. 562; Schlegel, Essai, II, 1837, p. 569, exclus. homon. *C. tergeminus* Say; Duméril, Bibron, Erp. Gen., VII, 1854, p. 1477.

*Caudisoma miliaria* Fitzinger, Neue Class., 1826, p. 63; Wagler, Nat. Syst. Amph., 1830, p. 176; Gray, Zool. Misc., 1842, p. 51; Fitzinger, Syst. Rept., 1843, p. 29.

Icones. Catesby, Hist. Car., II, t. XI. II. Bonnaterre, Ophiologie, t. I, f. 1, Schlegel; Essai, t. XV, f. 17, 18. Holbrook, N. Amer. Herp., III, t. IV. Dum., Bibr., Erp. Gen., LXXXIV bis. f. 5. U. S. Pac. R. R.

Surv. Rept., x, Reptiles, t. XXIV, f.

**Austroriparian Region.**

***Crotalophorus catenatus* Rafinesque.**

*Crotalinus catenatus* Raf., American Monthly Magazine, IV, 1818, p. 41, teste Garman Mem. Mus. Comp. Zool., Cambr., VIII, 3, p. 118.

Two geographical races or subspecies of the *catenatus* have been described. They differ as follows:

Scales in twenty-three rows; colors paler; dorsal spots narrower; lateral spots smaller ..... *C. c. edwardsii*.

Scales in twenty-five rows; colors darker; dorsal spots wider; lateral spots larger ..... *C. c. catenatus*.

***Crotalophorus catenatus edwardsii* Bd. and Gird.**

*Crotalophorus edwardsii* Bd. and Gird., Cat., 1853, p. 15; Duméril, Bibron, Erp. Gen., VII, 1852, 14; Baird, U. S. and Mex. Bound. Surv., 1851, p. 15.

*Caudisoma edwardsii* Cope Check List Batr. Rept. N. Amer., 1875, 34.

*Crotalus miliaris* Jan. Icon. Gen. Ofid., II, 46, III, fig. 6.

Icones. U. S. Pac. R. R. Expl. Rept., x, Reptiles, tab. XXIV, f. 8, (loreal plate incorrect); U. S. and Mex. Bound. Surv., t. V, f. 1.

***Crotalophorus catenatus catenatus* Raf.**

*Crotalinus catenatus* Raf., Amer. Month. Magaz., IV, 1818, p. 41.

*Sistrurus catenatus* Garman, Mem. Mus. Comp. Zool., Cambr., VIII, 3, p. 118.

*Crotalus tergeminus* Say, Long's Exped. Rocky Mts., I, 1823, p. 499; Boie, Isis, 1824, p. 270; Harlan, Journ. Acad. Nat. Sci., v, 1827, p. 372; Boie, Isis, 1827, p. 563; Duméril, Bibron, VII, 1-54, 1479.

*Crotalophorus tergeminus* Gray, Synops. Rept., 1830, p. 78; Holbrook, N. Amer., Herp., III, 1842, p. 29; Gray, Cat. Brit. Mus., 1849, p. 18; Baird and Girard, Catal., 1853, p. 14.

- Crotalophorus kirtlandii* Holbrook, N. Amer. Herp., III, 1842, p. 31; Gray, Cat. Brit. Mus., 1849, p. 18; Baird and Girard, Catal., 1853, p. 16.
- Crotalophorus massasauga* Kirtland, Baird, Serpents of New York, 1854, p. 11; Agassiz, Lake Superior, 1850, p. 381.
- Caudisoma tergemina* Wagler, Nat. Syst. Amph., 1830, p. 176; Cope, Check List N. Am. Batr. Rept., 1875, p. 35.
- Icones. Holbr. N. Amer. Herp., III, f. 5, 6; Agassiz, Lake Superior, t. VI, f. 8; Baird, Serp. New York, t. I, f. 2; Ibid., U. S. Pac. R. R. Expl. Rep., x, Rept., t. xxv, figs. 9, 11.

Northwestern and north central eastern region.

### CROTALUS Linn.

- Systema Naturae, ed. x, 1758, p. 214; ed. XII, 1766, p. 572; Lacépède, Histoire Naturelle des Serpens, II, 1789, p. 130 (nec Linnæi); Daudin, Histoire Naturelle des Reptiles, v, 1802, p. 297; Cuvier, Règne Animal, II, 1817, p. 77; Wagler, Natürlich. Syst. der Amphibien, 1830, p. 176; Schlegel, Essai sur la physionomie des Serpens, II, 1837, p. 555; Gray, Zoological Miscellany, 1842, p. 51; Fitzinger, Systema Reptilium, 1843, p. 29; Gray, Catal. Brit. Museum, 1849, p. 19; Baird et Girard, Catal. Serps. Smiths. Inst., 1853, p. 1; Duméril, Erp. Générale, VII, 1854, p. 1453; Cope, Bull. U. S. Natl. Museum, 32, 1887, p. 63.
- Caudisoma* Laurenti, Spec. Syn. Rept., 1768, p. 92; Cope, Smithsonian Contrib. to Knowledge, Researches on the venom of the Rattlesnake, by S. W. Mitchell, M. D., 1860, p. 119.
- Uropsophus* Wagler, Natur. Syst. der Amph., 1830, p. 176; Gray, Zool. Misc., 1842, p. 51; Fitzinger, Syst. Rept., 1843, p. 29; Gray, Cat. Brit. Mus., 1849, p. 19.
- Urocrotalon* Fitzinger, Systema Reptilium, 1843, p. 29.

Urosteges individed; tail terminating in a jointed rattle. Top of head covered with scales. Body cylindric.

The above simple diagnosis embraces the characters which distinguish the genus *Crotalus*. This type, the most specialized of the order Ophidia, is chiefly distributed in North America, to which, if we regard the Mexican plateau as a part of it, twelve of the fifteen species are restricted. Two species are found in South America, but none occur in the West Indies. Within the Regio Nearctica the distribution of species is very unequal. Thus but one species, the *C. horridus*, is confined to the eastern district. A second, the *C. adamanteus*, exists in the Austroriparian district, but extends itself from this region westward across and through the Sonoran district as far as the Pacific Ocean, occupying also the Lower Californian district. This distribution is only imitated by the *Bascanium flagelliforme* among North American reptiles. The Central and Pacific districts are occupied by another species, *C. confluentus*, which also extends over the northern part of the Sonoran district. To the latter are confined five species: *C. molossus*, *C. tigris*, *C. cerastes*, *C. lepidus*, and *C. pyrrhus*, which are all of rather small dimensions except the first and last named. Two others are confined to the Lower Californian Peninsula, *C. mitchellii* and *C. enyo*, while two are restricted to the Mexican plateau and its western slope, the *C. polystrictus* and *C. basiliscus*.

The variation in structure of these species is not great, and they

form a compact generic division. Dr. Coates has proposed to separate the *C. cerastes* as type of a separate genus distinguished by the prolongation of the free border of the superciliary plate into a hornlike process. Were this process distinctly articulated at the base from the superciliary plate, as is the case in the viperine genus *Ocerastes*, we should be compelled to adopt such a division; but at present I do not see the way to separate it, especially as the process is often but little pronounced. I have also proposed a generic division for the *C. lepidus* based on the single nasal plate, but the plate is sometimes divided in part, and for the present I do not adopt the division or at least until I can see more specimens of the species.

The origin of the curious epidermal structure at the end of the tail known as the rattle is as yet a subject of speculation only. We have, however, so many rudiments of it in other generic divisions of the *Crotalidæ* that its origin from some of these is evident, and that it occurred at no very late period of geologic time is probable. The terminal caudal vertebræ are coöstituted and compressed and expanded into a vertical body which enters the first or basal button of the rattle. Such a modification is found in a rudimental condition in the genus *Lachesis*, where it is covered by a simple horny sheath, grooved at the sides. In *Crotalophorus* the rattle is of absolutely and relatively small size, and here we can see the beginnings of the segmentation and inflation of the joints, which constitutes the perfected structure. The physiology of formation of these segments has not been studied as yet, but the general theory of the origin of the entire structure is probably the same in this case as in others in the animal kingdom. The violent vibrations into which most snakes throw their tails when excited has determined nutritive processes to its extremity and produced the excessive growth.

The species of this genus are of rather sluggish movements, and are not quick to bite, unless trodden on. They throw the body into a coil and sound the rattle, giving a sigmoid flexure to the anterior part of the body, on which the head is poised with open mouth ready for action. At this time drops of the poisonous saliva fall from the fangs, and by a violent expulsion of air from the lungs are thrown at their enemy. In the act of biting the movement is threefold. First, there is the spring of the body, which never exceeds two-thirds of its length; second, the bite proper, caused by the seizing by the jaws; and, third, the clutch with the fangs themselves, which are moved freely backwards and forwards by the flexor and extensor muscles of the maxillary bone on the prefrontal as a fixed point. This grasping movement may be observed in *Crotali* when very much excited and anxious to bite, and may be performed by the snake's head when severed from the body. I had a narrow escape from being bitten in this way by the head of a *Crotalus molossus*, which was attached to the body by skin only.

Rattlesnakes live in all kinds of ground, but naturally persist longest in rocky regions, where they have abundant places of concealment.

Some of the species grow to a very large size, particularly the *C. adamanteus* of North, and the *C. durissus* of South America. The former is probably the larger of the two; at least we have information of larger specimens. I am credibly informed that specimens have been found on the islands of the Gulf coast of Florida of 8 feet in length. Some specimens of the Western subspecies *C. a. atrox* also reach a large size. The third species in dimensions is the *C. horridus*, which grows on the coast of North Carolina to a length of 5 feet, and proportionate thickness. The species of the plains, *C. confluentus*, rarely reaches so large a size. Its gray-greenish color readily conceals it in the sparse vegetation and it is only observed when closely approached. It is very abundant north of the Missouri River, and extends north to the Saskatchewan, beyond the line of distribution of any other species.

The following synopsis of the characters of the species of *Crotalus* is the result of long familiarity with them. Some of the forms originally regarded as species are treated as subspecies, owing to the evanescence of their characters. In spite of the subdivision of their head plates, the homologues of the plates of harmless snakes may be traced. Thus there are from two to three preoculars, and from one to four loreals. The nasals are never more than two, and the nostril is always between them. There is one pair of genaeals. The species of section I display homologues of internasal and prefrontal plates, while the same, more divided, are seen in species of section II.

The transitional forms or subspecies in this genus, as is usually the case, furnish instructive evidence as to the evolution of the characters of the species. It is not improbable, as already remarked, that their origin is from some genus like *Lachesis*, which has a scaly head and no rattle.

I. Top of muzzle with three pairs of symmetrical shields in contact. (Scales in twenty-nine rows.)

Longitudinal bands on neck; tail uniform brown above; four rows of scales below orbit; yellow with black rhombs embracing yellow centers.

*C. durissus*.

Longitudinal bands on neck; four rows of scales below orbit; brown above with darker, light edged rhombs ..... *C. terrificus*.

No longitudinal bands on neck; tail yellow brown; large adjacent chestnut red yellow-bordered dorsal rhombs, alternating with lateral chestnut spots; labials fourteen; two and three scales below eye. . . . *C. basiliscus*.

No longitudinal bands on neck; tail black; brownish yellow above, with small transverse reddish dorsal rhombs, the angles produced as vertical lateral bands; five scales below eye..... *C. molossus*.

II. Top of muzzle with numerous scales.

A. Nasal plate in contact with rostral; superciliary border not extended into a process.

α. Tail entirely black.

Rostral plate elevated; scales of canthus rostralis larger than those between them; postocular band passing above mouth angle; angular spots above uniting into double chevroned cross-bands; scales twenty-five;

*C. horridus*.

αα. Tail light, with black cross-bands.

Postocular band reaching mouth anterior to canthus; dorsal rhombs on a paler ground; no neck stripes; scales 25-9 ..... *C. adamantus*.

*ααα*. Tail with brown or indistinct bands.

*β*. Rostral plate more elevated.

Muzzle with the marginal scales larger than the median; scales 23-7; three rows of brown dorsal spots, the median large; postocular band passing above canthus oris ..... *C. confluentus*.

Eight smooth longitudinal plates on top of muzzle; two loreals; scales twenty-seven rows; a postorbital spot; five rows of dorsal spots;

*C. polystictus*.

Six smooth square plates on top of muzzle; one loreal; scales twenty-three rows; three rows of dorsal spots, the median large ..... *C. triseriatus*.

*ββ*. Rostral plate less elevated.

Eight smooth plates on top of muzzle; scales in twenty-three rows; green with black rings; no postocular band ..... *C. lepidus*.

Small smooth scales on top of muzzle; one loreal; colors pale; subquadrate dorsal spots which become transverse bands posteriorly ..... *C. tigris*.

Small keeled scales on top of muzzle; two loreals; colors contrasted; dark brown spots above becoming first transverse rhombic and then cross-bands posteriorly; a postorbital band passing above canthus ..... *C. enyo*.

*AA*. Nasal plate in contact with rostral; border of superciliary produced into a horn-like process.

Small smooth scales on top of muzzle; colors pale, the dorsal spots small; cross-bands on tail of the same color; scales twenty-one rows ... *C. cerastes*.

*AAA*. Nasal plate separated from rostral by scales; superciliary not prolonged.

Rostral low; tail black-ringed; one loreal plate; yellow with quadrate punctulate brown dorsal spots, becoming cross-bands posteriorly;

*C. mitchellii*.

Rostral low; tail brown and black-ringed; four loreal plates; red with dark red spots becoming cross-bands ..... *C. pyrrhus*.

### *Crotalus molossus* Bd. and Gird.

*Crotalus molossus* Bd. and Gird, Cat. Rept. N. Amer. 1853, p. 10; Baird, U. S. et Mex. Bound. Surv. Reptile, 1859, p. 14; Cope Check List N. Am. Batrach. and Rept. 1875, p. 33; Cope and Yarrow U. S. G. G. Surv. W. of 100th Mer. v, 1875, p. 533; Cope Proc. Acad. Phila., 1883, p. 12.

*Crotalus ornatus* Hallowell, Proc. A. N. S. Phila. VII, 1854, 192, U. S. Pac. R. R. Expl. Rept., 1859; Parke's Rept. Reptiles, p. 23.

Icones. U. S. Pac. R. R. Rept. Reptiles, xxiv, f. 5. *Ibid.*, Parke's Rept. tab. ii. U. S. and Mex. Bound. Surv., tab. III.

The Sonoran region; as yet only near the Mexican boundary.

### *Crotalus adamantus* Beauv.

Palisot de Beauvois Trans. Amer. Philos. Soc. IV, 1799, 368; Cope, Check List N. Amer. Batr. Rept. 1875, p. 33.

The subspecies differ as follows:

Entire top of head covered with irregular flat scuta larger than the usual scales; body colors paler than tail bands; dorsal rhombs with truncated angles; one loreal plate ..... *C. a. scutulatus*.

Top of head with large plates on canthus rostralis, but scales elsewhere; two loreal plates; dorsal rhombs complete, not paler than caudal bands; last caudal band a wide ring ..... *C. a. adamantus*.

Top of head with plates on canthus, and scales between; generally one loreal plate; dorsal rhombs paler than bands of tail, which is not black at end;

*C. a. atrox.*

Scales of canthus rostralis not larger than those between them; one loreal plate; red, dorsal rhombs not distinct; tail white with black bands;

*C. a. ruber.*

***Crotalus adamanteus scutulatus* Kenn.**

Cope, Check List Batr. Rept. N. Amer., 1875, p. 33; Report U. S. G. G. Surv. W. 100th Mer., V. 1875, p. 607; Proc. Am. Philos. Soc., 1885, p. 287.

*Caudisona scutulata* Kenn., Proc. Acad. Phila. 1860, p. 207; Cope, Proc. Acad. Phila., 1866, p. 307-309.

**Arizona and Chihuahua.**

***Crotalus adamanteus adamanteus* Beauv.**

Cope, Check List Batr. Rept. N. Amer., 1875, p. 33.

*Crotalus adamanteus* Pal. de Beauvois, Trans. Am. Phil. Soc. iv, 1799, 368; Holbrook, N. Am. Herp., III, 1842, 17; Bd. and Gird., Cat. Serpt. N. Amer. 1853, p. 3; Le Conte, South. Med. and Surg. Journ. ix, 1853, 664, Jan Icon. Gen. Ofid. 46 ii, Fig. 2.

*Crotalus horridus* Bonnat. Ophiologie, 1790, p. l. Excl. cit. Linn. Mus. Ad. Fried, et Tab.

*Crotalus rhombifer* Latreille, Hist. Rept. III, 1801, 197"; Daudin, Hist. Rept., v, 1802, 525; Duméril, Bibron, Erp. Gen., vii, 1854, 1471.

*Crotalus durissus* Shaw, Gen. Zool., II, 1802, 333.

*Crotalus terrificus* Le Conte, Proc. Acad. Nat. Sci. Phila. vi, 1853; Excl. homon. *Caudisona terrifica* Laur. p. 418; Cope, loc. cit. 1859, p. 337. Excl. homon. *terrifica* Laur.

*Crotalus oregonus* Holbrook, N. Amer. Herp. III, 1842, 21; Bd. and Gird.; Cat. Serpt. 1853, p. 145.

Icones, fShaw, Gen. Zool. III, t. l. xxxix. Daudin, Hist. Rept. v, Pl. ix, Figs. 22, 23. Holbrook, N. Amer. Herp., III, t. II. U. S. Pacific R. R. Rept. Reptiles, tab. xxiv, f. 2.

**Austroriparian region.**

***Crotalus adamanteus atrox* Bd. and Gird.**

Cope, Check List Batr. Rept. N. Amer., 1875, p. 33; Report U. S. G. G. Survey W. 100th Mer. v, 1875, p. 607.

*Crotalus atrox* Bd. and Gird., Cat. Serp. N. Amer., 1853, p. 5; Baird, U. S. and Mex. Bound. Surv. Reptiles, 1859, p. 1; U. S. Pacific R. R. Rept., x, Whipple's Rept.

Icones, U. S. and Pac. R. R. Rept. Reptiles, t. xxiv, f. 3, U. S. and Mex. Bound. Surv., Reptiles, t. I. *Crotalus adamanteus* Jan, Icon. Gen. Ofid. III, 46, ii, Fig. 1.

**Sonoran region; dry parts of Texas; Lower California.**

***Crotalus adamanteus ruber* Cope.**

Rostral plate a little wider than high; plates of upper side of canthus rostralis smaller than in other subspecies, the posterior especially smaller than the anterior, and partly decurved laterally. One loreal. Five rows of scales between orbit and labial; eight rows between super-

ciliary plates. Second pair of inferior labials with the marginal portion cut off from the postsymphysal portion. (Perhaps an abnormality.)

The color is light red, marked above with deep red spots. These are of a longitudinal oval form anteriorly, but posteriorly they have a diamond-shaped form. They have no distinct lateral borders, either light or dark; but they are separated on the median line of the back by a single row of yellow-tipped scales. Traces of brownish red indefinite spots opposite their lateral angles as well as their intervals. Head without marking, except a faint trace of a pale line from the eye to the border of the mouth below it. Inferior surfaces yellow. Tail white with five black cross bands, of which all but the first are complete rings.

9209; 27, 17: 186, 26: 1245<sup>mm</sup> (with rattle); 122<sup>mm</sup> with rattle; rattle (seven joints and a button) 44<sup>mm</sup>.

This peculiar and handsome form is connected with the subspecies *atrox* by the specimen 8856, which has a similar head scutellation. The absence of either light or dark borders to the dorsal spots in the *C. a. ruber* gives it a much more aberrant appearance.

*Crotalus adamanteus ruber* Cope.

Catalogue No.	No. of specimen.	Locality.	From whom received.	Nature of specimen.
9209	1			Alcoholic.

*Crotalus confluentus* Say.

Say Longs. Exped. Rocky Mountains II, 1823, 48; Cope Check List N. Amer. Batr. Rept., 1875, p. 33, Coues' Report U. S. G. G. Survey W. of 100th Mer., p. 604; Cope, Proc. Acad. Phila., 1883, p. 11.

Top of muzzle with smaller scales between large ones of the canthus rostralis. Rostral plate elevated, in contact with the prenasal. One or two loreals; three or four rows between eye and labial scales. Body scales in twenty-three to twenty-seven rows, all keeled except the external three on each side.

Color light brown, with one row of dark-brown spots, usually paler edged on the median line of the back, which are generally longer than wide anteriorly, but soon become transversely oval, and ultimately assume the form of crossbands. Tail of the same color as the body, with crossbands of the color of the dorsal spots. Belly unspotted, but with dark shades in some forms.

Four well-defined subspecies are embraced in this species; they are defined as follows:

Cephalic scales larger; four rows between superciliary plates; four rows below orbit; dorsal spots and cephalic bands light edged; few posterior crossbands. *confluentus*.  
Cephalic scales intermediate; six rows between superciliaries; three rows below orbit (probably sometimes four); dorsal spots square, with the headbands not light-edged; posterior crossbands more numerous; colors dotted with brown specks. .... *pulverulentus*.



Cephalic scales smallest; eight rows between superciliaries; four rows below orbit; dorsal spots with light centers and brown borders light-edged or not; headbands obsolete; numerous posterior crossbands.....*lecontei*.  
 Head scales small as in *C. c. lecontei*; colors dark; dorsal spots and bands not pale-centered and closer together than in *C. c. lecontei*; head wide, rounded....*lucifer*.

The distribution of these subspecies is as follows: The typical one inhabits the plains, including also western Texas and southern California; *C. c. lecontei* belongs to the Great Basin; the *C. c. pulverulentus* is a form of the Sonoran district; while the *C. c. lucifer* inhabits the Pacific district to its eastern limit, the northern Rocky Mountains.

***Crotalus confluentus confluentus* Say.**

Cope, Proc. Acad. Phila., 1883, p. 11.

*Crotalus confluentus* Say, Long's Exped. Rocky Mts., II, 1823, p. 48; Bd. and Gird. Cat. Serpt. 1853, N. Amer., p. 8; Baird, U. S. and P. R. R. Surv. Rept., 1859, Whipple's Rept., p. 40; U. S. and Mex. Bound. Surv., Reptiles, p. 14; Cooper et Suckley, Nat. Hist. Wash., 1859, Ter., p. 295.

Icones.—Sitgreave's Exped. Colorado and Zuñi, Tab. XVIII, (icon. pej.), U. S. Pac. R. R. Surv. Rept., Reptiles, Tab. XXIV, Fig. 4; *Ibid.*, Williamson's Rept., Reptiles, Tab. III; Cooper and Suckley, Nat. Hist. Wash. Ter., Tab. XII.

Central and Sonoran regions; southern California.

***Crotalus confluentus pulverulentus* Cope.**

Proc. Acad. Phila., 1883, p. 11.

Southern New Mexico.

***Crotalus confluentus lecontei* Hallow.**

*Crotalus lecontei* Hallow., Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 80; Rept. Exp. Zuñi and Colorado River, Sitgreaves, p. 139, 1853; U. S. Pac. R. R. Rept., x; Williamson's Rept., 1859, p. 18.

*Crotalus confluentus lucifer* Cope, Proc. Phila. Acad., 1883, p. 77.

The Great Basin (Oregon to Arizona).

***Crotalus confluentus lucifer* Bd. and Gird.**

*Crotalus lucifer* Bd. and Gird., Proc. Acad. Nat. Sci. Phila., 1852, p. 177, et (1853) Cat. p. 6, Girard, Herpetology, U. S. Expl. Exped. 1858, p. 187; Baird, U. S. Pacif. R. R. Rept., x; Williamson's Rept., 1859, p. 10; Cooper et Suckley, Nat. Hist. Wash. Ter., 1859, p. 295.

Icones.—U. S. Pac. R. R. Surv. Rept., Williamson's Rept., Reptiles, Tab. XI; Girard, Herp., U. S. Exp.; Tab. xv, Figs. 1-6.

Pacific Region.

***Crotalus lepidus* Kenn.**

*Crotalus lepidus* Kennicott, Proc. Acad., Phila., 1861, Phila., p. 206; Cope, *loc. cit.* 1873, p. 13.

*Aploaspis lepida* Cope, Report U. S. G. G. Surv. W. of 100th Mer., 1875, p. 535; Cope Check List Batr., Rept. N. Amer., p. 33.

New Mexico; south Arizona.

*Crotalus tigris* Kenn.

*Crotalus tigris* Kennicott, U. S. and Mex. Bound. Surv., II, 1859, p. 14; Cope in Yarow, U. S. G. G. Surv. W. of 100th Mer., v, 1875, p. 534; Cope Check List N. Amer. Batr., Rept., 1875, p. 33.

Icones.—U. S. Mex. Bound. Surv., loc. cit., Tab. iv.

New Mexico; Arizona

*Crotalus enyo* Cope.

*Crotalus enyo* Cope, Proc. Acad. Phila., 1861, p. 293; Cope, Check List N. Amer. Batrach. and Reptiles, 1875, p. 33.

Lower California; southern California.

*Crotalus horridus* Linn.

Syst. Nat., Ed. x, 1758, p. 214, et XII, I, 1766, p. 572; Primó cit., Mus. Ad. Fr., I, 39; ubi "Frons tecta squamis obtusissimis, palpebræ superiores planæ magnæ" legatur. Porro Catesby Caro. Hist. (A.) et Amœnitat. Acad. (B.) citantur. (A. "*Vipera caudiseona, Americana*" et "*V. C. a. minor*" describuntur, pp. 41, 42; sed *V. C. a. minor* caputscutis magnis instructum habet.") (B. In. Amœn. Acad., II, p. 139, *C. durissæ* (hujus enumerationis) (Amœn. Acad., I, 500) citatur! et "*Virginianis rattlesnake*" denominatur!) Secundo cit. Seba, 95, f. I, ubi *C. terrificæ* delineatur!! Shaw Gen. Zoöl., III, 1802, p. 317; Cuvier, Règne Animal, II, 1817, p. 78; Gray, Synopsis Rept., 1830, p. 78; Guerin Incongr., R. Anim., † 1830, Tab. u. 23, f. 2; Griffith, Cuv. Règne Animal, IX, 1831, p. 267; Le Conte, Proc. Acad. Nat. Sci., Phila., VI, 1853, p. 417; Cope, Proc. Acad. Phila., 1859, p. 338.

*Crotalus durissus* Latreille, Hist. Rept., III, 1801, p. 190; "Daudin, Hist. Rept., v, 1802, p. 304, exclus. cit. Linn., Laurenti, Lacép.; Harlan, Journ. Acad. Nat. Sci., Phila., 1825, p. 368, exclus. cit. Linn., Laur.; *Ibid.*, Med. and Phys. Res., 1825, p. 132; Schlegel, Essai sur le Phys. Serp., II, 1837, p. 365, exclus. descrip. color., p. 366, et homon, *Uropsophus triseriatus* Wagl., et *Crot. confluentus* Say; Storer, Report Rept. Mass., 1839, p. 233; Holbrook, N. Amer. Herp., III, 1842, p. 9, exclus. cit. Linn.; Dekay, Zoöl. of New York, Pt. III, 1842, p. 55, exclus. cit. Linn., Say, Le Conte, Southern Med. and Surg. Journ., 1853, p. 663; Bd. and Gird., Cat. Serp. Smiths. Inst., 1853, p. 1, exclus. cit. Linn., Baird, Serpents of New York, 1854, p. 9, exclus. cit. Linn., Duméril, et Bibron, Erp. Gen., VII, 1854, p. 1465, exclus. cit. Linn., Latreille, Wagler, Baird, U. S. Pac. R. R. Expl. Surv., x, 1859. Whipple's Rept. Reptiles, 1859, p. 39, exclus. cit. Linn.; † Jan. Rev. et Mag. de Zoöl., 1859, p. 153; Jan. Icon., Gen. Ofid., III, p. 46; Figs. 1 and 2.

"*Crotalus atricaudatus* Latreille, Hist. Rept., III, 1801, p. 209;" † Boie, Isis von Oken, 1827, p. 562; Wagler, Nat. Syst. Amphib., 1830, p. 177; Gray, Zoöl. Miscell., 1842, p. 51.

*Urocrotalon durissus* Fitzinger, Syst. Rept., 1843, p. 29.

*Urosophus durissus* Gray, Cat. Brit. Mus., 1849, p. 19, exclus. cit. Linn. et homon.

*Confluentus* Say, *rhombifer* Latr., *triseriatus* Wieg., Wagl., Gray.

† *Crotalus catesbæi* Hempr., Fitz., Neue class, 1826, p. 63, fide Gray.

† *Urocrotalon Catesbyanum* Fitz., Diesing, Syst. Helminth., II, 1851, p. 431.

Icones.—Catesby, Hist. Car., II, Tab. XLII; Lacépède, Serp., II, Tab., XVIII, f. 3.; Shaw, Zoöl., III, T. LXXXVII. Daudin, v, Tab. LXVIII. Guerin, Iconogr. R. Animal, T. XXIII, f. 2; Schlegel, Essai, xx, f. 15, 16; Diet. Univ. Hist., Nat. Atlas, II, T. XIII, f. 1; Dum., Bibr. Erp., Gen. Atlas, t. LXXXIV, bis. Fig. 1; Holbrook, N. Amer. Herp., III, T. 1; Dekay, Zoöl. New York, Pt. III, Atlas, Fig. 19; Baird, Serp. New York, T. I, f. 1; U. S. Pac. R. R. Expl. Rept. x, Reptiles, T. XXIV, Fig. 1.

Eastern and Austroriparian regions, except Floridian district; river bottoms of eastern part of central region to central Kansas.

This is not the *C. durissus* of Linn, as supposed by various authors. That the latter name applies to the South American species is shown by the description given by Linnæus Syst. Nat. Ed. XII, 1766, p. 572.

***Crotalus cerastes* Hallow.**

*Crotalus cerastes* Hollowell, Proc. Acad. Nat. Sci., 1854, Phila., p. 95; Hallowell, U. S. Pac. R. R. Expl. Report, 1859; Williamson's Rept. Reptiles, p. 17; Baird, U. S. and Mex. Bound. Surv., 1859, Reptiles, p. 14; Cope Check List N. Amer. Batr., 1875, Rept. 33.

*Crotalus (Æchmophrys) cerastes* Cones, Report U. S. G. G. Surv. W. of 100th Mer., 1875, p. 609.

Arizona.

***Crotalus mitchellii* Cope.**

*Crotalus mitchellii* Cope, Proc. Acad. Phila., 1861, p. 293, Check List, N. Amer. Batr. Rept., Cope, 1875, p. 33; Cope; Yarrow in Report U. S. Geol. G. Surv. W. of 100th Mer., 1875, p. 535.

Lower California; southern California.

***Crotalus pyrrhus* Cope.**

*Candisona pyrrha* Cope, Proc. Acad. Phila., 1866, pp. 308-310; Cones, U. S. G. G. Surv. W. of 100th Mer., 1875, p. 608.

*Crotalus pyrrhus* Cope., U. S. G. G. Surv. W. of 100th Mer., 1875, p. 535, Pl. XXII; Check List, Batr., Rept. N. Amer., p. 33.

Arizona; Lower California, (Angel Id. teste Yarrow).

## NOTE ON THE GENUS HIATULA OF LACÉPÈDE OR TAUTOGA OF MITCHILL.

BY

THEODORE GILL, M. D., PH. D.

In the twelfth edition of the "Systema Naturæ," p. 475, Linnæus named a Labroid fish *Labrus hiatula*: the name was based on "a half-skin without anal fin," still preserved in the Linnæan collection, and which was recognized by Messrs. Goode and Bean as the *Tautoga onitis*. (Proc. U. S. Nat. Mus., 1882, p. 571), after it had already been identified with it by previous authors. Upon this fish Lacépède (v. 2, p. 522) based a genus for which he appropriated the name *Hiatula*. In 1883 (Proc. U. S. Nat. Mus., 1882, p. 571), Messrs. Jordan and Gilbert proposed to replace the generic name *Tautoga* of Mitchill, previously generally used, by *Hiatula* and under the name *Hiatula onitis* the species was entered in their "Synopsis of the Fishes of North America" (p. 600) and in many later publications. The name itself and the incidents connected with it are so repugnant to one's sense of propriety that doubtless all that have adopted it have done so with reluctance. The fact that it need not be retained, or rather that it can not be legitimately retained, will therefore doubtless be welcomed.

The name *Hiatula* has been given to four different associations of species or peculiar species, viz:

### HIATULA.

Martini, Verzeichniss einer auserlesenen Sammlung von Naturalien und Kunstsachen u. s. w., p. 141, 1774 (*Solen*, etc.).

Modeer, K. Vet. Acad. Handl., p. 178, 1793.

Lacépède, Hist. Nat. Poissons, v. 2, p. 522, 1800.

Swainson, Elements Mod. Conch., p. 14, 1835 (*Agaronia* Gray.)

Inasmuch as Modeer at least was a binomial author, his name has unquestionable priority over Lacépède's, and consequently precludes the adoption of the same for the genus of fishes, whatever may be thought of the merits of the genus proposed for the bivalve shells. Modeer's name has been adopted, however, by various recent authorities on Mollusks as the designation of the genus otherwise called *Soletellina*, or *Solenotellina*, by Blainville; among those who have thus adopted the name are Tryon in his Manual of Conchology (v. 3, p. 167), and Prof Hutton, in his "Revision of the Recent Lamellibranchiata of New Zealand" (Proc. Linn. Soc. New South Wales, v. 9, p. 520, 1884).



## NOTE ON THE GENUS CHONERHINUS OR XENOPTERUS.

BY  
THEODORE GILL, M. D., PH. D.

### I.

In Dr. Günther's Catalogue of the Fishes in the British Museum, (vol. 8, p. 270, 1870) in the subfamily *Tetrodontina* (which includes the *Tetrodontidae* and *Diodontidae*) a genus is admitted with the following data:

#### 2. *Xenopterus*.

*Xenopterus* Bibron, Rev. Zool., 1855, p. 281.

*Chonerhinus* Bleek., Atl. Ichth. Gymnod., p. 77 (not before characterized).

The data thus given are quite misleading, but in almost every year since 1870 there has been some reference to the genus in question in which they have been assumed to be correct. In an important memoir by Dr. Vinciguerra on the Fishes of Burma, just published, and even by Dr. Jordan, *Xenopterus* has been used instead of *Chonerhinus* or *Chonerhinos*. In fact, the only one who has accepted either form of the name except its inventor has been myself.\* The reasons why I have used that name rather than *Xenopterus* I will now give, for such are called for in view of the fact that for over twenty years a false light has been followed without any other discovering the truth.

### II.

In 1854 Dr. Bleeker, in his "Vijfde Bijdrage tot de Kennis der ichthyologische Fauna van Celebes," proposed a new generic name for the *Tetraodon modestus*† and *T. naritus* and gave diagnoses of four genera into which *Tetraodon* was subdivided by him. The new genus was thus defined: "*Chonerhinos* Blkr. door trechtervormige verdieping ter plaatse der neusopeningen met verhevene randen, lange rug- en aarsvinnen, zichtbare zijlijn en ongekielden rug."

In other words, and in plain English, it is proposed to distinguish *T. modestus* and *T. naritus* generically from *Tetraodon* because there are, in place of the nasal openings, funnel-shaped depressions with raised margins; long dorsal and anal fins; a conspicuous lateral line, and a keelless back.

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\* *Chonerhinidae* Gill, Proc. U. S. Nat. Mus., 1884, p. 423.

† The name "*Chonerhinos modestus* = *Tetr. modestus* Blkr. ib. N. T. I, p. 16, III 440" occurs in the N. T., v. 7, p. 69.

The diagnosis will be thus seen to be sufficient if not complete and as good as those subsequently given by Bibron and Günther. Dr. Günther could not have noted that "*Chonerhinus*" was "not before characterized" if he had known Bleeker's memoir, which, it is to be borne in mind, is not referred to by him.

In 1855 M. Auguste Duméril published extracts from unpublished MSS. of the late M. Bibron relative to the gymnodont plectognaths, and among them a diagnosis of a genus called *Xénoptère*,\* viz:

10° G. *Xénoptère* Bib. (ξένος, étrange, inusité; περιεξ, nageoires). "Narines en forme de cupule plissée intérieurement.—Des épines sur les côtés de la tête et le ventre seulement. Epiptère et hypoptère beaucoup plus longues que hautes; uroptère arrondie."

*Espèce unique*: *X. Bellangerii* Bib.

In 1878 Gill† adopted the name *Xenopterus* and made the genus the type of a subfamily *Xenopterinae*.

In 1880 Dr. Günther‡ degraded the genus to a subdivision of *Tetraodon*, under which it would only appear as a section.

In 1884 Gill§ recognized the priority of *Chonerhinus* and raised the including group to family rank under the name *Chonerhinidae*.

In 1886 Jordan and Edwards|| with reference to the considerable number of dorsal and anal rays in *Lagocephalus*, expressed the opinion that "this increase in the number of fin rays marks a slight step in the direction of the genus *Xenopterus* (*Chonerhinus*)." They also accepted the "family of *Tetraodontidae* as including all the Plectognathous fishes in which the teeth in each jaw are coalesced into a bony plate, which in each jaw is divided by a median suture," but restricted the name *Tetraodontinae* to the *Tetraodontidae* as limited by me in 1884. They excluded *Xenopterus* from both their subfamilies by the terms of their diagnoses and consequently by implication admitted the subfamily *Xenopterinae*.

### III.

It will thus be seen that in 1855 (1) the name *Xénoptère* was alone given and (2) no *described* type was mentioned. For both reasons, therefore, some naturalists at least (and for the first, President Jordan certainly), if the facts were known, would reject the name.¶ On the other hand, (1) a good Latin name was given by Bleeker, (2) described species were specified, (3) a good generic diagnosis was supplied, and (4) the given name was published before any other. Unquestionably,

\* Note sur un travail inédit de Bibron relatif aux Poissons Plectognathes Gymnodonts. . . . <Rev. et Mag. Zoöl., (2,) v. 7, pp. 274-282 (281), 1855.

† Gill, Johnson's Univ. Cycl., v. 4, p. 792.

‡ Günther, Int. Study Fishes, p. 689.

§ Gill, Proc. U. S. Nat. Mus., v. 7, p. 423.

|| Jordan and Edwards, U. S. Nat. Mus., v. 9, pp. 230-236.

¶ See Jordan and Edwards, Proc. U. S. Nat. Mus., v 9, p. 233.

therefore, the name given by Bleeker (being likewise not preoccupied) must be accepted.

The Latin form of the generic name, *Xenopterus*, was not given till 1857, when Hollard used it in his memorable "Études sur les Gymnodontes," the first memoir in which the genera of a large group of fishes were diagnosed by details drawn from comparative anatomy.

A summary of the facts thus made known is embodied in the following synonymy.

## IV.

## CHONERHINUS.

## SYNONYMY.

=*Chonerhinos* Bleeker, Nat. Tijd. Ned. Indië, v. 7, p. 69 (name only); p. 259 (characterized) 1854.

=*Xénoptère* Bibron, Rev. et Mag. Zoöl. (2), v. 2, p. 281, 1855. (Without reference to a described species.)

=*Xenopterus* Hollard, Ann. Sc. Nat. (4), v. 8, p. 321, 1857. (Cranium of *X. Bellangeri* figured.)

=*Chonerhinus* Bleeker, Atlas Ich. Néerland. Indies, v. 5, pp. 49, 77, 1865.

*Tetraodon* sp. Richardson.

*Tetrodon* sp. Bleeker olim, Günther, 1880, 1886.

Inasmuch as Bleeker himself corrected *Chonerhinos* to *Chonerhinus*, I have accepted the latter; I am tempted to still further change the name to *Chonorhinus* (in analogy with *χωνοειδης*), but for the present at least forbear to do so.

## V.

In 1839-1841, Johannes Müller, in a note to the third part of his *Vergleichende Anatomie der Myxinoiden*,\* set apart a section of the old genus *Tetraodon*, as follows:

Andere *Tetrodon* haben keine Spur von Naslöchern und an dieser Stelle einer hautartigen trichterformigen Tentakel, *Chelonodon*, Nob.

No species was mentioned in connection with this notice.

The diagnosis is applicable, so far as it goes, to *Chonerhinus*, and it is quite likely that it was based on that type. It has, however, been accepted for a section including the "*Tetrodon patoca*," "*T. viridipunctatus*," and "*T. Waandersii*," as by Dr. Günther (Cat. Fishes B. M., v. 8, pp. 272, 288), defined as follows:

C. A simple, non-perforate nasal cavity with a fringed edge. Body spiny: *Chelonodon*, Müll.

As I have none of the species mentioned I hold opinion in abeyance.

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\* Abhandl. Berlin, Akad., 1839, p. 253, 1841.





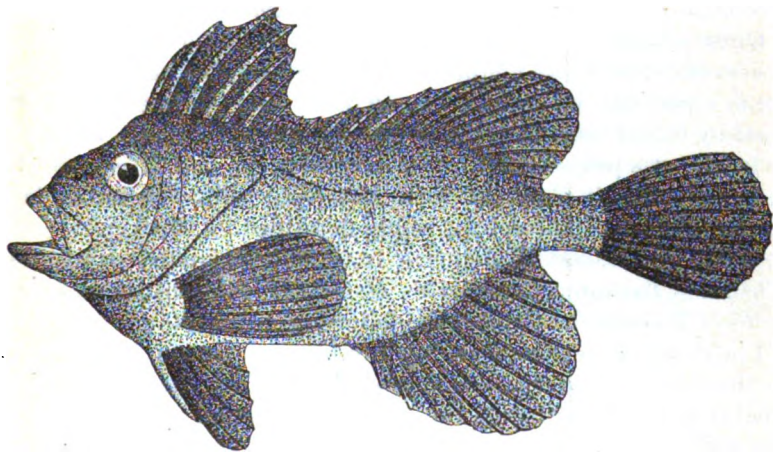
## ON THE GENUS GNATHANACANTHUS OF BLEEKER.

BY

THEODORE GILL, M. D., PH. D.

### I.

In 1855 (over thirty-five years ago), Dr. Bleeker introduced into scientific literature a remarkable genus of fishes under the name *Gnathanacanthus* for a species (*G. goetzi*) found in Van Diemens Land, and referred it to the family *Cataphracti*. Subsequently, in several memoirs, he referred it to the family *Scorpenoidei*.\* Nevertheless, it was overlooked by Dr. Günther and has been neglected by all recent authors.



GNATHANACANTHUS GOETZI.

In 1876, Dr. Günther proposed the name *Holoxenus* for a fish (*H. cutaneus*), also found in Van Diemens Land or Tasmania, and referred it to the family *Cirrhitidae*. Dr. Günther added, "This is one of the most singular fishes of the Tasmanian fauna. At the first glance the observer is inclined to refer it to the *Scorpenidae* or *Pediculati*; but there is no bony stay for the preoperculum, which is not armed, and the fore limb is not pediculated. Its nearest allies are evidently the *Cirrhitidae*."

In 1876, Dr. Bleeker demonstrated the identity of *Holoxenus* with *Gnathanacanthus*, and claimed that he was right in referring the genus

\* One of these memoirs was published in 1876, and a notice is in The Zoölogical Record for 1876 (Pisces, p. 15), immediately following the abstracted diagnosis of *Holoxenus*. In that notice appears "*Gnathanacanthus* (type 2 *G. goetzi*, Blkr, sp. n. ? not yet described, D. & A. §), p. 299." *Gnathanacanthus goetzi*, as already indicated, was described and illustrated twenty years before.

to the Cataphracti, and especially the *Scorpenoidei* in the following terms:

"La chaîne sousorbitaire y est en effet complète et s'articule avec le préopercule, mais les os sont rudimentaires en ce sens, qu'ils forment des plaques très-minces, dont le postérieure, de forme oblongue et de presque la longueur de l'orbite, se rétrécit en arrière pour s'y articuler avec le préopercule vers le milieu de la hauteur de son bord postérieur."

In 1878, Count Castelnau noticed a fish which he referred to a new genus called *Beridia* or *Baridia* (*B. flava*),\* and which he referred to the family *Triglidae*, with the following explanation:

"This new genus belongs to the *Triglidae*, and its spinous dorsal being rather less developed than the soft, ought probably to be placed in the group *Cottina*, but the general form is very different from all the other fishes of *Triglidae*, and is more like some sorts of *Gobiidae*."

In 1879, the present author, in a brief summary of the progress of Vertebrate Zoölogy in 1878, referred to *Beridia* in the following terms:

"Quite a large number of new genera of fishes have been proposed, but several of them are unquestionably the result of imperfect knowledge or erroneous ideas, and among such may be mentioned those named by Count Castelnau (1), *Brisbania* and (2) *Baridia* or *Beridia*. The former was proposed for a fish occurring in the Brisbane River, and is undoubtedly identical with *Megalops*, while the latter is the same as *Gnathanacanthus*, long before described by Bleeker."†

In 1883, Mr. Robert M. Johnson, in an ably compiled catalogue of the fishes of Tasmania, enumerates *Holoxenus cutaneus* as one of the species of *Triglidae*, and added the following comments:

"I have not seen the above, but I have good reason for supposing that the fish, not otherwise mentioned, known as the *Velvet fish*, is probably the same, although the spinous characters are not in agreement with those of *H. cutaneus*."

A description is then given of the *Velvet fish*, and it is added, "Should it prove to be a distinct species I propose for it the name *Holoxenus Güntheri*."‡

## II.

The nominal genera and species thus introduced are undoubtedly congeneric. Whether they are based on the same species is not so clear. The differences of the radial formula are considerable, viz :

	D.	A.	C.	P.
<i>Gnathanacanthus Gatz.</i> .....	7   5   11	3.9	.....	.....
<i>Holoxenus cutaneus</i> .....	7   3   10	[3].9	12	.....
<i>Beridia flava</i> .....	5   8   10	2.8	12	10
<i>Holoxenus Güntheri</i> .....	8   5   10	3.9	12-13	.....

\* On the plate (2) the name is printed *Baridia flava*.

† Ann. Rec. Sc. and Ind. 1878, p. 458, 1879.

‡ Papers Royal Soc. Tasm., 1882, pp. 114, 115, 1883.

§ In specific diagnosis, 7 spines; in generic, 8; in figure, 8.

The spines intervening between the anterior and posterior elevated portions of the dorsal appear to be very slender and short, and it is possible that two or three may have been overlooked, and that also anal spines may have been passed over. For the present, at least, it is uncertain whether there is more than one species of *Gnathanacanthus*, and possibly, even the doubt is against the probability of there being more than one. This is a problem for the Tasmanian and Victorian naturalists to elucidate.

### III.

The color of the *Gnathanacanthus Gatzii* was described by Bleeker as brownish red; of *Holoxenus cutaneus* by Günther as "uniform whitish (in spirits);" and of *Beridia flava* by Castelnau as "entirely of a beautiful orange color." Mr. Johnston has informed us that in *H. Güntheri*, "the color, when fresh, is a uniform deep purple, sometimes more or less marbled with yellow, which probably changes to white in spirits." In this connection, a statement by Castelnau is especially noteworthy. "Having received it in a dry state [he] put it in warm water to extend some parts of the fins; the water became almost immediately of the same beautiful yellow color as the fish." It therefore seems that the pigments of the fish are soluble, as are those of the feathers of certain birds—especially the musophagids—and consequently discrepancies as to shade of color are of little account.

### IV.

The facts respecting the history are summarized in the following synonymy:

#### GNATHANACANTHUS.

##### *Synonymy.*

- =*Gnathanacanthus* Bleeker, Verhand. K. Akad. Wet., (Amsterdam), v. 2, Visschen Van Diemensland, p. 21, pl. f. 1, 1855.
- =*Holoxenus* Günther, Ann. and Mag. Nat. Hist. (4), v. 17, p. 393, 1876; Macleay, Proc. Linn. Soc. N. S. Wales, v. 5, p. 438, 1881; \* (Cat., p. 138.)
- =*Beridia* Castelnau, Proc. Linn. Soc., N. S. Wales, v. 2, p. 229, 1878; Macleay Proc. Linn. Soc., N. S. Wales, v. 5, p. 592, 1881; † (Cat., p. 227.)
- =*Baridia* Castelnau, Proc. Linn. Soc., N. S. Wales, v. 2, pl. 2.

The genus is not mentioned by Dr. Günther in his Introduction.

### V.

Which of the propositions as to the relationships of *Gnathanacanthus* is true? Is it one of the *Scorpenidae*, or one of the *Cirritidae*—or is it the representative of an independent family?

The plates accompanying Bleeker's and Castelnau's memoirs show characters quite different from those manifest in any *Scorpenids* or

\* Referred to the *Scorpenidae*.

† Referred to the *Cottinae*.

Cirritids. The eyes are near the proximal ends of the preopercular bones, the proscapular bones are very much inclined backwards, and must consequently connect with the posterotemporals at decided angles, the pectorals are comparatively narrow and consequently the actinosts and coracoid elements must be modified, and the ventrals are subbrachial. Notwithstanding Bleeker's remarks, I must regard it as doubtful whether the normal cataphract structure is manifest, that is, whether the *third* suborbital is developed as a stay. In view of the combination of characters exemplified the genus appears to be referable to neither the Scorpænids nor the Cirritids, and it probably represents a peculiar family to be called *Gnathanacanthidae*. It *may be* most nearly related to the Congiopodids or Agriopodids and the Patæcids. It is very desirable that the questions thus submitted should be investigated, and to rectify the nomenclature and to direct attention to a peculiarly interesting type, unduly neglected, this article is presented. The author would be greatly obliged to any one who would favor him (or rather the U. S. National Museum) with specimens or with any bones of the fish.

## VI.

Inasmuch as *Gnathanacanthus* (or *Holoxenus*), *Congiopus* (or *Agriopus*), and *Patæcus* have been widely separated and associated with very different forms, I venture to express my belief that that they will be found to be related, and may even constitute a single superfamily. They agree superficially in the pauciradiate simple rayed pectorals, advanced spinous dorsalis, and position of eyes. I trust that skeletons or specimens to be skeletonized of the several types may be sent to the U. S. National Museum for examination.

## NOTES ON THE TETRAODONTOIDEA.

BY

THEODORE GILL, M. A., M. D., PH. D.

(With Plate XXXIV.)

### I.

After the completion of my "Note on the genus *Chonerhinus* or *Xenopterus*," it appeared to me to be desirable to review several other questions concerning other genera of *Tetraodontoidea* and the taxonomic values of the included forms.

All the *Tetraodontoidea* were included by Linnæus in a single genus and are still so included by Günther. Gill proposed to differentiate them under three families. The gradations between those extremes are many.

### II.

No deliberate attempt was made to subdivide *Tetraodon* among genera till nearly four decades of the present century had elapsed. Swainson, in 1839, gave generic names to five sections under which Cuvier segregated the species.\* Johannes Müller soon after proposed other generic names, some of which were anticipated by Swainson. Bleeker, Bibron, and Peters added other genera. Bibron especially had skeletons of many species prepared for a contemplated monograph of the group which he first recognized as a family, "*Tétrodoniens*." These skeletons were utilized by Hollard in 1857 in *Études sur les Gymnodontes*, in which he recognized six genera on osteological characters, scientifically appreciated the relative values of their characters, and combined them in a *tribu* or subfamily. Bleeker disregarded the osteological characters, and based the genera admitted by him on characters derived from the carination or planeness of the back, extent of the snout, form of nostrils,† and dermal appendages. The next step was violently retrograde. Günther ignored all the excellent work done by Hollard, and reduced all the *Tetraodontoidea* to two genera combined with the *Diodon*-

\*The genera proposed by Lacépède for two species, *Spheroides* and *Ovoides*, were due to unmitigated ignorance and strange blundering respecting their characters.

†"Nares utroque latere foraminiformes in papilla concava plus minusve elevata perforatæ" in *Tetraodon*; "Nares utroque latere tentaculum simplex vel duplex" [etc.] in *Crayracodon*; "Nares utroque latere infundibuliformes imperforatæ" in *Leiodon*, *Chonerhinus*, and *Ephippion*.

*tidæ* to constitute a single group of his family called *Gymnodontes*. He subsequently made another retrograde step and reverted to the Linnæan conception of the genus, combining all in one genus, *Tetrodon*.

Meanwhile the work of Hollard remained unknown or neglected. In 1884, Gill recognized this work, utilized his material for a systematic revision of the group, elevated the Linnæan and Güntherian genus *Tetrodon* (*Tetraodon*) to superfamily rank, and divided it into three families distinguished by osteological characters. In the framework thus reared, Jordan and Edwards, in 1887, intercalated all the species of American *Tetraodontoidea*, but degraded the group to family rank and the families to subfamilies.

Jordan and Edwards's memoir is excellent and the first one in which scientific principles were applied at the same time generally and in detail to the consideration of the group. The range of the genera, so far as the American species are concerned, appears to be natural and their nomenclature nearly correct. There are some questions involved, however, which merit reconsideration and I propose to now pass in review all the genera that appear to be well established.

### III.

#### 1758) TETRAODON. (Linnæus.

Jordan and Edwards have reached the same conclusions as I formerly did respecting the application of the name *Tetraodon*, but by a different route. I should not have considered it necessary to discuss the question involved if a fallacy had not found way in their argument which might be repeated in various other cases. Under the circumstances, a review of their argument may be useful. I first give their own words :

The name *Tetraodon* first appears as a generic term, so far as known to us, in Hasselquist's *Travels in Palestine*, edited by Linnæus, in 1757. We have not examined this work, but our impression is that it is binomial in form, and that the name *Tetraodon* is here associated only with *Tetraodon fakaka*, the *Tetraodon lineatus* of the *Systema Naturæ*, and a member of the group called *Arothron*.

If this work of Hasselquist be taken in consideration, the name *Tetraodon* must be assigned to the present group.

But the conventional starting point of binomial nomenclature is later, and in the *Systema Naturæ*, Linnæus includes all the species of the present family known to him, in the genus *Tetraodon*.

We must then consider the later attempts at restriction of the group.

In 1839, Swainson made the first attempt at generic division.

Retaining the name *Tetrodon* for the bulk of the species (including our genera *Spharoides* and *Tetraodon*), he separated from it *Lagocephalus*, *Leiodon* (or *Leisomus*), *Cirrhisomus*, and *Canthigaster* (or *Psilonotus*).

The first and last of these were well defined. The others, *Leiodon* (based on the absence of prickles) and *Cirrhisomus* (based on the presence of cirri), rest on characters of no systematic importance. Under the generic name of *Tetrodon*, four species are mentioned as types. Three of these belong to the *Arothron* group; the other is a *Chelonodon*. But none of them are Linnæan species, although one of them (*testudi*

*nus* Bloch, not L.) was supposed by Swainson to be such. If we regard, with Dr. Gill, this subdivision to be properly a restriction of the Linnæan genus, the name *Tetraodon* would again be synonymous with *Arothron*. But it may be objected that the *Tetrodon* of Swainson contained no species known to Linnæus, and hence its composition can not be considered as a proper restriction. This objection seems to us a valid one.

The next subdivision seems to be that of Müller (1841), who retained the name of *Tetrodon* for none of his divisions.

Next (1855) we have the subdivision of Bibron. By him the group was divided into a large number of genera, part of them without definition and all of them with French names only. For one of his sections the name *Tetraodon* was retained. This group, as arranged by Bibron, included a single Linnæan species as type. This one, *lineatus*, is a member of the group called by Müller *Arothron*. This seems to be the first proper restriction of *Tetrodon*, and, so far as we can see, it must stand, making *Tetraodon* the equivalent of *Arothron*.

Later, 1857, Holland worked over the material of Bibron, and adopted—on skeletal characters only—an arrangement of genera, not unlike that given in the present paper. His genera are *Xenopterus* (not American), *Rhynchotus* (= *Canthigaster*), *Batrachops* (= *Colomesus*), *Brachycephalus* (= *Tetraodon*), *Apsicephalus* (= *Sphæroides* and *Lagocephalus*), *Monotreta* (not American).

Holland supplies a Latin form to the French names of Bibron, and using the name *Tetrodon* as a general term, he places Bibron's *Tetraodon* as a subgenus under his own *Brachycephalus*.

In 1867, Bleeker, probably regarding *lineatus* as the proper type of *Tetraodon*, seems to have suppressed the latter name as a synonym of the name *Crayracion*, used by Klein before the date of the *Systema Naturæ*. Other ichthyologists do not give Klein's names precedence over those of Linnæus, and under the rules of nomenclature which we adopt, *Crayracion* must be disregarded.\*

In 1873, Prof. Gill used the name *Tetrodon* as synonymous with *Lagocephalus*, and in 1885 as synonymous with *Arothron*. In 1883, Jordan and Gilbert regarded *T. testudineus* as its type, thus making it synonymous with *Sphæroides*.

It seems evident to us, from the above data, that it is best to regard *Tetraodon lineatus* as the type of *Tetraodon*, and thus make the latter name the equivalent of *Arothron*.

The fallacy in this argument is in considering the name *Tetraodon* in the same light as a new generic name. Swainson did not pretend to enumerate all the species of the genus. He simply selected some, of which there existed figures in a couple of illustrated works accessible to himself. Inasmuch as those so selected were congeneric with Linnæan species, those Linnæan species were by implication included and actually do belong to the genus as limited by Swainson. Of course, if Swainson had given a new generic name, the name could only have been retained for species actually included by him under the genus named; as it was, he simply limited a genus already established, and the genus so limited included, by the terms of its diagnosis, two of the five original species of *Tetraodon*, while not more than one Linnæan species belongs to any other genus.

I revert, with Jordan and Edwards, to the name *Tetraodon* for this

\**Tetraodon* and *Crayracion* were both used by Bleeker, the former being applied to the genus *Lagocephalus* and the latter being essentially equivalent to *Arothron* of Müller, or *Tetraodon* of Jordan and Edwards and American authors.



genus, that being the form originally used by Linnæus (1758, p. 352). The change of the name to *Tetrodon* by Linnæus, Günther and other authors was unnecessary, inasmuch as the original form is sanctioned by classical usage, as in the case of *τετραοδία* and *τετραοδος* (quadrivium), *τετραόρυλος* (four fathoms in extent), *τετραορία* (four-horsed chariot), etc.

The genus appears to contain few species. Four have been referred to it by Bibron, (1) *T. lineatus* Linn.; (2) *T. patoca* Horn (Buchanan); (3) *T. dorso-unicolor* Bib.; and (4) *T. bouronensis* Bib. The last two have never been described, and it is not known what they are. The *T. patoca* has been referred to a distinct section of the genus by Dr. Günther. The absence of specimens in the National Museum prevents me from forming an opinion.

1798.) SPHEROIDES. (Lacépède) Duméril.

The nomenclature of this genus has been considered by Jordan and Edwards,\* Jordan† alone, Gill,‡ and again by Jordan§ alone, and Bollman,|| and we have now no points of difference; all American authors who have expressed their sentiments¶ are of the same opinion. Reluctant as I am to adopt the name given under the condition *Spheroides* was, there seems to be more possibility of agreement by so doing than by any other course.

A notice of *Anchisomus* has been overlooked. It occurs in remarks by Richardson on "*Anchisomus reticularis* (Kaup)."

"The species of this genus mentioned in Dr. Kaup's list are *Anchisomus Spengleri*, *angusticeps*, *multistriatus*, *reticularis*, *scalaris*, *geometricus*, and *turgidus*. *Anchisomus*, *Gastrophysus*, *Cheilichthys*, and *Leiosomus* form a group of *Tetrodontidae*, in which the nasal cavity is small and flat, with two nostrils."\*\*

1839.) LAGOCEPHALUS. (Swainson.

The nomenclature of this genus is now clear, and therefore needs no consideration here.

1839.) CANTHIGASTER. (Swainson.

*Canthigaster* is now accepted by me in place of *Psilonotus*, formerly used. Richardson (in 1854)†† and Bleeker (in 1859) employed *Psilonotus*, and in 1876 and 1884 I followed them in so doing. Jordan and Ed-

\* Jordan and Edwards < Proc. U. S. N. M., 1886, p. 233.

† Jordan, < o. c., 1887, p. 481.

‡ Gill, < o. c., 1888, pp. 607, 608.

§ Jordan, < o. c., 1889, pp. 183, 651.

|| Jordan and Bollman, < o. c., 1889, p. 183.

¶ Gilbert, < o. c., 1890, p. 455. Evermann and Jenkins, < o. c., 1891, p. 165.

\*\* Zool. Voyage Herald, 1854, p. 162.

†† Richardson described the typical *P. rostratus* as "*Prilonotus* (or *Anchisomus*) *caudacinctus*." *Prilonotus* was evidently a slip for *Psilonotus*.

wards, however, have shown good reason for not doing so longer, and also reason not good. Their own words may be reproduced :

The proper name of the genus has been involved in some confusion, owing to the use by Swainson of two different names for it.

On page 194 of his miserable work on the classification of fishes, Swainson gives an analytical key to the genera, and applies to the present group the name of *Canthigaster* (correctly written *Acanthogaster*). No species are here mentioned by Swainson, but in this case his diagnosis is accurate and sufficient. On page 328, these genera are again defined, the present one in nearly the same way, but under the name of *Psilonotus*. Two species (*rostratus*: *electricus*) are here mentioned as types.

Professor Gill has preferred to adopt the last-mentioned name, regarding *Canthigaster* as unidentifiable except through the medium of the species mentioned under the diagnosis of *Psilonotus*. Dr. Bleeker has preferred to take the earlier name of *Canthigaster*. In this case it is certainly true that no doubt could exist as to what Swainson intended to include under *Canthigaster*, even had the second diagnosis been omitted; moreover, the name *Psilonotus* is preoccupied. We see, therefore, no sufficient reason for setting this name aside, objectionable as it is.

I can only account for Jordan and Edwards's assertion that Swainson's diagnosis of *Canthigaster* is "sufficient" by the surmise that they have considered the diagnosis of *Psilonotus* instead of *Canthigaster*. The sole diagnosis of Swainson's *Canthigaster* is in the words: "*Canthigaster*: Muzzle prolonged and narrow; belly with spines." Now, if Messrs. Jordan and Edwards consider this sufficient, I do not, and I find it as applicable to some species of "*Sphæroides*," especially *S. angusticeps*, as to the species recently referred to *Psilonotus*. Indeed, the resemblance of *S. angusticeps* to the *Psilonoti* is so great as to have misled two incomparably better ichthyologists than Swainson—Richardson and Steindachner—who actually referred that species to the genus, the former calling it *Anchisomus angusticeps* and the latter *Canthogaster lobatus*.\*

Nevertheless, Jordan and Edwards were quite right in correcting me for adopting the name *Psilonotus*, but only because that name had been preoccupied in Hymenoptera, a fact of which I was not aware in 1884.

Under the circumstances, however, it may be doubtful what name to take up for the genus in question. *Canthigaster*, with its apparent etymology, is a very objectionable name, and its application, as already urged, could not have been certainly determined "except through the medium of the species mentioned under the name of *Psilonotus*." But as it can be so determined, I am disposed, after Bleeker, Jordan, and Edwards, and some others, to adopt it. It would naturally be supposed that the name was intended to allude to the spiniferous belly, and Swainson undoubtedly labored under the delusion that "*canthi*"—or, "*canthus*" was a good Greek derivative for spine.† Swainson, however,

\*The external difference between the species of *Canthigaster* are marked but they are not indicated by the words of Swainson.

†See *Canthophrys* (vol. 1, p. 364; vol. 2, p. 310), *Canthileptes* (vol. 2, pp. 7, 52, 179, 261), *Genicanthus* (vol. 2, pp. 170, 212), *Polyoanthus* (vol. 2, pp. 175, 242), etc. Another delusion was that *leptes* was a Greek derivative for scale or scaled.

did not actually give the etymology of his name and those who would be distressed by the form of the name may derive it from *Canthus*, one of the Argonauts, and *gaster*, belly, and assume it to refer to the ability to swell the belly\* and thus float along. Bleeker attempted to correct the word to *Canthogaster* and used the name *Canthogastrini* as the designation of a "phalanx" in his system. Jordan and Edwards have preserved the form *Canthigaster* and used *Canthigasterinae* as a subfamily name. I propose also to retain the name *Canthigaster* and derive from it the family name *Canthigasteridae*.†

1839.) LEIODON. (Swainson.

In 1839 Swainson introduced a new generic name with the following diagnosis:

*Leisomus* Sw.—Head short; the body entirely smooth.

*T. laevisimus*. Sch.‡

*marmoratus*. Hamilt. pl. 18, fig. 3, *T. (Monotretus) cutcutia*, G. viii, 290.

On a previous page he had, in the same sequence under *Tetraodinae*, the following genus:

*Leiodon*.—Head short; body entirely smooth.

No species was mentioned.

*Leisomus marmoratus* was a substitute for *T. cutcutia* of Hamilton. There is no "*T. laevisimus*" in Bloch and Schneider's "*Systema Ichthyologiae*," and Swainson has simply copied the name from the Règne Animal of Cuvier, who, in his second section of the genus *Tetraodon*, characterized by the entire body smooth, grouped two species: "*T. laevisimus* Bl., Schn."; and "*T. cutcutia*, Buchan, XIII, 3."

There is a *Crayracion laevisimus* of Klein‡ (the *Spheroides maculatus*), and Cuvier may have, by slip of memory, substituted "Bl., Schn." for Klein. But, as it is, the first species of Swainson's genus is indeterminate and the merits of his genus (for practical purposes) must be determined by the only species identifiable. That species is typical of a good genus and, for a wonder, Swainson's diagnosis is applicable and almost distinctive, though the full force of it can only be appreciated by one who knows the crania of the genera of *Tetraodontinae*.

In 1855 Bibron introduced a new generic name, *Monotrète*, for the *T.*

\*Unfortunately the species of the genus are less endowed with this capacity than the typical *Tetraodontidae*.

‡According to Richardson (Zööl. Herald, p. 162), "*Prilonotus* is a name invented by Müller, and is mentioned by him in his 'Fortsetzung der Myxinoden,' and the Archiv für Naturgeschichte für 1841, but I have not found his detailed account of the characters. Dr. Kaup enumerates the following species: *Pril. rostratus* Lin. (*margaritatus* Rüppell, *solandri* Richardson), *millipunctatus*, *occipitalis*, *oculifer*, *insignitus*, *caeruleo-punctatus*, and *pictus*." The appearance of the nasal depression is fully described as it appeared to Richardson. As already indicated, *Prilonotus* is a slip for the Swainsonian name *Pylonotus*, and does not occur in Müller's work.

‡*Crayracion laevisimus* Klein Hist. Pisc. Nat. prom. Miss. tertius, p. 18, pl. 3, f. 5, 1742.

*cutcutia*, and the genus was subsequently well defined from cranial characters by Hollard, as *Monotreta*.

Bibron diagnosed a genus in the following terms:

8.° *G. Monotrète*, Bib. (*μόρος*, seul, *ρπερος*, troué, percé). "Narines n'ayant chacune qu'une seule ouverture circulaire à bord non saillant. —Point d'épines sur aucune partie du corps, qui est complètement lisse. —Nageoires impaires arrondies; épistère et hypostère courtes."

*Espèce unique*: *T. cutcutia*, Ham. (Buchanan).

In 1865 Bleeker united *Monotreta* with *Leiodon*, expressing the following opinion respecting Hollard's views:

Il fit un seul genre des *Crayracion* et des *Leiodon*, tout en conservant le genre *Monotreta* Bib. qui cependant ne diffère pas des *Leiodon*.

Bleeker adopted the genus *Leiodon* of Swainson rather than *Leisomus* or *Leiosomus* or *Liosomus*, for the following reasons:

Le nom générique de *Leisomus* mériterait donc d'être conservé s'il n'avait pas été employé, avant Swainson, en 1831, pour un genre de Coléoptères. Or, Swainson dans son *Natural History of Fishes*, etc., employa aussi (p. 194), pour indiquer son genre *Leisomus*, le nom de *Leiodon*, et c'est par conséquent ce nom, qu'il aurait dû du reste écrire *Liodon*, qui a le droit de priorité sur celui de Joh. Müller.

I can not corroborate the statement that *Leisomus* or *Leiosomus* or *Liosomus* had been employed in zoölogy before its use by Swainson, although *Leisoma* and *Liosoma* had been frequently used. While I for myself should have preferred the name *Liosomus*, I acknowledge Bleeker's right to choose one of two names simultaneously given, and consequently accept *Leiodon*, as that name does not appear to have been previously used, either in that form or under the guise of *Liodon*.

In 1870 Günther accepted the name, under the modified form *Monotretus*, for a section of *Tetrodon*, including only the *T. cutcutia*, with the following diagnosis:

D. A simple circular nasal cavity. Body smooth: *Monotretus* (Bibr.).

The other species of *Leiodon* noticed by Bleeker were referred to another section, viz:

C. A simple, not perforated nasal cavity with a fringed edge. Body spiny: *Chelonodon* (Müll.).

The genus thus appears to have been based on decided external as well as cranial characteristics and is therefore adopted.

The history of the genus is summarized in the synonymy.

#### LEIODON.

= *Leiodon Swainson*, Nat. Hist. Fishes, etc., vol. 2, p. 194, 1839.

= *Leisomus Swainson*, Nat. Hist. Fishes, etc., vol. 2, p. 328, 1839.

= *Monotrète Bibron*, Rev. et Mag. Zoöl, (2), vol. 7, p. 281, 1855.

= *Monotreta Hollard*, Ann. Sc. Nat., (4), vol. 8, p. 322, 1857.

< *Leiodon Bleeker*, Atlas Ich. Nierland Ind., vol. 5, p. 47, 1865.

= *Monotretus Günther*, Cat. Fishes, B. M., v. 8, pp. 272, 290, 1870. (Section of *Tetrodon*.)

= *Liosomus Gill*, Proc. U. S. Nat. Mus., vol. 7, p. 422, 1884.

*Tetraodon* sp., *Hamilton et al.*

*Leiodon* sp., *Bleeker* (1865).

1841.) CHELONDON. (J. Müll.)

This name has been already considered in my article on *Chonerhinus* and therefore needs no further discussion here. It is very desirable, however, that a renewed examination of proper material should be undertaken to solve the doubtful questions that still exist.

1841.) AROTHRON. (J. Müller.)

In 1839 Johannes Müller, in his "Vergleichende Anatomie der Myxinoiden," (published in 1841,\*) gave new generic names to several types of Tetraodontids, *Physogaster*, *Chelonodon*, *Cheilichthys*, and *Arothron*, presenting the following diagnosis of the last:

Noch andere, wie *Tetrodon testudinarius*† haben statt der Nasen jederseits ganz solide Tentakeln, in welche der starke Geruchsnerve geht. Diese haben auch einen Ringmuskel um das Auge und eine Art Augenlider, die Untergattung *Arothron*.

Coördinate with the ring muscle is the deflection of the postfrontals, and especially the prefrontals, to describe the segment of a circle.

In 1855 a diagnosis of a genus was published in the following terms:

2° G. *Dilobomyctère*, Bib. (δις, deux, λοβός lobe, μυκτήρ, narine). "Tête courte. Narines se présentant sous la forme d'un double tentacule aplati.—Des épines au ventre et sur diverses autres parties du corps. Nageoires impaires arrondies; épiptère et hypoptère courtes.

To this genus were referred eleven species, (1) *T. reticularis* Schn., (2) *T. hispidus* Bloch (including six varieties), (3) *T. maculatus* Lac. (including four varieties), (4) *T. meleagris* Lac., (5) *T. nigropunctatus* Schn., (6) *T. mappa* Less., (7) *T. diadematus* Rüpp., (8) *T. longicauda* Bib. (named *T. manillensis* Marion de Procé and *T. strigosus*, Benn.), (9) *T. sordidus* Rüpp., (10) *T. immaculatus* Lac., and (11) *T. Ruppellii* (= *T. Honkenii* Rüpp., not Bloch).

This genus has been confounded by Jordan and Edwards, as well as others with *Tetraodon*, but it differs decidedly in osteological characters. and has been associated with the Bibronian genera *Aphanacanthus*, *Amblyrhynchotus*, *Stenometopus*, *Geneion*, *Epipedorhynchus*, and *Promecocephalus* in a comprehensive group, to which a new generic name, *Apsicephalus*, was given by Hollard, while the typical *Tetraodon* was united with *Dichotomycter* in another supergeneric group called *Brachycephalus* by Hollard.

*Arothron*, being the prior name and based on the typical species of *Dilobomycter*, should be adopted.

1854.) CHONERHINUS. (Bleeker.)

The facts respecting this genus have already been detailed in a previous article on the genus and therefore need not be repeated here.

\* Abhandl. Berlin Akad., 1839, p. 252, 1841.

† *Tetrodon testudinarius* (see Archiv für Naturg., 9. Jahrg., p. 330, 1843) is the *Tetrodon reticularis* Schn. (See Gthr. Cat. fishes, v, 8, p. 296.)

## 1855.) AMBLYRHYNCHOTUS. (Bibron.

In 1855 A. Duméril published from the MSS. of Bibron the following diagnosis of a genus of *Tetraodontidæ*.

4° *G. Amblyrhynchote*, Bib. (ἀμβλύς, obtus, ρυγχος, museau). "Narines ayant la forme d'un tube court, clos au sommet, mais percé latéralement de deux ouvertures opposées. Museau obtus, un peu déclive.—Épiptère et hypoptère pointues, opposées l'un à l'autre."

Il y a quatre espèces: *T. Honckenii*, Bloch, *oblongus*, Bloch, *Richei*, Frémenville, *albo-guttatus*, Bib.

The National Museum has skeletons of *T. Honckenii* and *T. oblongus*, and also of *T. pardalis* (Temm. and Sch.), and these indicate a genus distinct from *Lagocephalus* to which they would be generally referred on account of agreement in the nasal structure. But further they indicate that there is considerable difference between *T. oblongus* and *T. pardalis* on the one hand and *T. Honckenii* on the other. I reserve the consideration of these differences and the nomenclature for a future occasion.

## 1855.) EPHIPPION. (Bibron.

In 1855 Bibron's name *Ephippion* was published with the following diagnosis:

9° *G. Ephippion*, Bib. (ἐφίππιον, selle). "Narines en cupule profonde; de ses bords s'élèvent trois tentacules aplatis, dont un est plus large, mais moins long que les autres.—Des épines au ventre; tête et queue lisses; dos et flancs revêtus d'une cuirasse de même nature que celle qui enveloppe la totalité du corps des *Coffres*.—Épiptère et hypoptère pointues, courtes; uroptère à rayons externes plus longs que les autres."

*Espèce unique: E. maculatum*. Bib.

The *E. maculatum* was not described.

In 1865 Bleeker, in a review of Bibron's system, concluded that *Ephippion* was the only genus with which Bibron enriched science and gave the following note on *E. maculatum*:

J'ai examiné, à Paris, des individus d'*Ephippion maculatum* Bibr. provenant de Tanager et de Gorée. La diagnose de Bibron est d'une rigoureuse exactitude. Les lames osseuses s'étendent jusques sur la queue. Les épines du ventre ont des racines divergentes. Il n'y a point de ligne latérale visible. D. 2/8. A. 2/7. C. 1/8/2. Couleur brun-olivâtre en dessus et blanchâtre en dessous. Dos et dessus des flancs ornés d'ocelles nacrés épars. Une large bande sousoculaire transversale brun-olivâtre. Nageoires roses; la base de la pectorale noirâtre.

In 1870, Günther recognized in the genus "*Tetrodon*" a section based on the *Tetraodon guttifer* of Bennett, to which he gave the new name *Hemiconiatus*. The section was defined in the following terms:

I. The dermal ossifications are in the form of spines and of scutes, the latter forming a continuous carapace round the trunk, *Hemiconiatus*.

The notices of Bibron and Bleeker of *Ephippion* were completely overlooked and ignored in the synonymy of the species, section, and genus *Tetrodon*. *Hemiconiatus* is in fact a synonym of *Ephippion*, and in order to learn the essential characters of *T. guttifer*, such as the

structure of the nostrils, the number of fin rays, and the color, recourse must be had to the previous notices of the *E. maculatum* of Bibron and Bleeker.\*

The synonymy of this form will then be as follows:

#### EPHIPPION.

= Ehippion *Bibron*, Rev. et Mag. Zool. (4), v. 7, p. 281, 1855.

= Ehippion *Bleeker*, Atlas Ich. Néerland. Ind., v. 5, pp. 47 (also printed *Ehippium*), 49, 1865.

= Hemiconiatus *Günther*, Cat. Fishes, B. M., v. 8, p. 272, 1870.

The type *E. guttifer* (= *Tetrodon guttifer* B.) is the only known species, and is confined to the northwest and west African coast.

*Ehippium* was apparently a mere slip for *Ehippion*. *Ehippium* had been twice used before 1854—by Bolten in 1798 for a genus of mollusks, and by Latreille in 1802 for a genus of dipterous insects. *Ehippion* had not been previously used, is sufficiently distinct from *Ehippium*, and has classical sanction, as in *logarion*.

#### 1884.) COLOMESUS. (Gill.

This genus was instituted in 1855 by Bibron and well diagnosed and illustrated in 1857 by Hollard. Its establishment therefore dates from 1855, but unhappily a name previously used in ichthyology (*Batrachops*), was taken by those excellent naturalists. In 1884 I was therefore obliged to give a new name. As the nomenclature is now clear, no further remarks are necessary.

Only one species is known, the *C. psittacus*, found in the northern streams of South America.

It is noteworthy that the first use of the name *Tetraodon* in ichthyology (so far as I know) occurs in connection with the type of this genus, which was called *Ostracion tetraodon* in Seba's work.

#### OTHER GENERA.

Such are the genera that appear to have undoubted claims for recognition in a scientific arrangement of the *Tetraodontoidea*. There is reason to believe, however, that among the genera named by Bibron there may be several others that require admission into the system. The "new species" named by that naturalist have never yet been described. More than a generation has passed away since they were announced, and it certainly is not to the credit of French ichthyologists that they have never been determined. We might reasonably have expected that two learned ichthyologists (Hollard and Bleeker), who have examined the collection, would have determined them. Hollard left his meri-

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\*Dr. Günther can not be blamed, however, for not having given such information, as his specimen (20 inches long) was "stuffed," and anyone who has to do with stuffed gymnodonts will acquit him of blame, since he tried to find the characters, as indicated by his queries as to the "nostrils?" and the number of dorsal rays, "nine-rayed. (?)".

torious work incomplete in that he did not do so, and must accordingly be especially blamed therefor. It may be hoped that the accomplished naturalist now in charge of the collection (Prof. Leon Vaillant) will soon have the work done, or, still better, do it himself.

#### IV. SYSTEMATIC RELATIONS.

In 1884 I expressed the hope that naturalists might "make use of their reasoning powers in considering [the three families of *Tetraodontoidea* then recognized] and not *assume* that they are unjustifiable because previous students had not appreciated their value." The hope, however, has not yet been realized. President Jordan, from whose vigorous and progressive intellect most might have been anticipated, reduced the families to subfamily rank, and thus reverted to my system of 1878. A few remarks seem to be called for in defense and support of my later views.

Such families as the *Percidæ*, *Serranidæ*, *Pristipomidæ*, *Sparidæ*, and *Squamipinnæ*, with varying limits, are recognized by almost all ichthyologists of the present time. Now what are the differences between them, compared with those between the three families into which the Tetraodontoids have been distributed? They depend, *as generally defined*, on slight differences in the dentition, armature of the opercular bones, and extension of the scales on fins. Even if we look into the internal structure, no very salient differences are observable; we become, from such an examination, convinced that the characters that have been generally used to differentiate the families are almost worthless as expressions of real affinities, but there is a striking general resemblance in the crania and in all other parts. Contrast with such characters the differences exhibited by the crania of representatives of the three families of *Tetraodontoidea*. The difficulty is, then, not to *ascertain the differences*, but to *appreciate the resemblances*. Many anatomists would fail at first glance to understand the comparative homologies of the bones exhibited by the several types of Tetraodontoids if they commenced their examination without any previous information. And yet, forsooth, the families of Acanthopterygian fishes are generally admitted, while one eminent ichthyologist unites all the Tetraodontoids in a *single genus*! Could inconsistency go farther?

The differences between one of these tetraodontoid families (*Chonerhinidæ*) and the others extend to the vertebral column in a marked degree; most have a greatly diminished number of vertebræ; therefore the order, to accommodate them, has been said to have "the vertebræ in small number;"\* the *Chonerhinids* have more vertebræ than a large proportion of the acanthopterygian fishes and certainly do not

\* Günther, Int. Study Fishes, p. 683, 1880.



have them "in small number." Various families of acanthopterygians have been distinguished on account of the numbers of vertebræ; the Carangids, for example, have been distinguished because they have "ten abdominal and fourteen caudal vertebræ." Fishes closely allied in other respects to the Carangids have been excluded because they have twenty five\* or more vertebræ.†

Let it be borne in mind that the differences in the number of vertebræ are *not* coördinated in the special cases of the acanthopterygians had in mind, with any other modifications. Yet an eminent ichthyologist unites the Tetraodontids and Canthigasterids having "the vertebræ in small number" (less than "ten abdominal and fourteen caudal vertebræ") with the Chonerhinids having the vertebræ in increased number ("more than ten abdominal and more than fourteen caudal vertebræ") in one and the same genus, although those differences *are* coördinate with numerous other structural modifications.

It is because President Jordan has probably been influenced by the treatment of the group under review by an eminent authority, and not allowed his own excellent and candid judgment to have full sway, that I feel constrained to comment on the inconsistency and want of scientific method involved in the examples in question. Far from fearing that I have gone too far in subdivision of the Tetraodontoideans, I feel that I have scarcely gone far enough. I should perhaps raise the Colomesines to family rank, and if I do not so do it is because I am desirous to appear not to go to an extreme. The recognition of the family value of the Colomesine group may be left to another or to some other time. Perhaps Mr. Boulenger, the learned herpetologist of the British Museum, may so elevate it.

That distinguished and really scientific herpetologist has employed a character, analogous to the principal one which distinguishes the Colomesines from the bulk of the Tetraodontids, to diagnose several families of lacertilians.‡ The Colomesines have the "postfrontals" so elongated and extended forwards as to unite with the "pre-frontals" and thereby exclude the narrowed frontals from the orbits, while the Tetraodontines have wide frontals entering into the roofs of the orbits. Three families of lizards are distinguished chiefly on account

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\* Many true Carangids have twenty-five or other than twenty-four vertebræ.

† The strict accuracy and absence of exaggeration of the statements here made may be inferred from facts. Dr. Günther, in his Catalogue of Fishes, referred *Naucrates* to the *Scombridæ* because it had Vert. 10-16 (p. 374), and referred *Seriola* (p. 462) and *Nauclerus* (p. 469) to the Carangidæ because they were supposed to have Vert. 10-14. Soon afterwards I demonstrated that two of the nominal species of *Seriola* and the six nominal species of *Nauclerus* were based on different stages of the youth of *Nasorates* and that probably all belonged to a single species. The correctness of this statement has long been universally accepted—even by Dr. Günther—and the genus *Naucrates* is now retained by all in the Carangidæ next to *Seriola*, where I placed it. (See Proc. Acad. of Nat. Sc. Phila., 1862.)

‡ See Boulenger, Cat. Lizards B. M., v. 1, pp. 1, 2.

of analogous extensions of the postfrontals and prefrontals\* and thereby the contraction of the frontals to the middle of the cranium—the *Pygopodidæ*,† the *Anniellidæ*‡ and *Helodermatidæ*.§

## V.

In conclusion I submit the revised synonymy and definition of the superfamily *Tetraodontoidea* and diagnoses of the three families. They are essentially the same as those published in 1884.

I add copies of the illustrations of the crania of the six genera of *Tetraodontoidea* published by Hollard. Those who may think I have gone too far in estimating the values of the groups so figured may judge from an attempt to recognize the homologies of the bones, how distant some of them are from each other. If they ought all to be combined in one genus, surely there should be no difficulty in recognizing the bones at once.

## TETRAODONTOIDEA.

*Synonym as superfamily name*

<Tetrodontoidea Gill, Cat. Fishes F. Coast N. A., p. 6, 1873.

=Tetrodontoidea Gill, Proc. U. S. Nat. Mus., v, 7, p. 419, 1884.

*Synonyms as family names.*

<Ostéodermes Duméril, Zool. Anal., p. 109, 1806.

<Odontini Rafinesque, Indice d'Ittiolog. Siciliana, p. 40, 1810.

<Osteodia || Rafinesque, Analyse de la Nature, p. 89, 1815.

<Gymnodontes Cuvier, Règne Animal, le éd., t. 2, p. 145, 1817; 2d éd., t. 2, p. 364, 1829.

<Gymnodontes Latreille Jour. Nat. Régne An., p. 115, 1825.¶

<Tetraodontidæ Bonaparte, Giorn. Arcad. di Scienze, v. 52 (Saggio Distrib. Metod. Animali Verteb., a Sangue Freddo, p. 39), 1832.

<Tetraodontidæ Bonaparte, Nuovi Annali delle Sci. Nat., t. 2, p. 131, 1838; t. 4, p. 186, 1840.

<Première famille [des Plectognathes] Daresse, Ann. Sc. Nat. (3), v. 14, p. 117, 1850.

<Gymnodontidæ Adams, Manual Nat. Hist., p. 95, 1854.

=Tetraodontiens Bibron, Revue et Mag. Zool., (2), t. 7, p. 279, 1855.

<Gymnodontidæ Girard, Expl. and Surv. for R. R. Route to Pacific Ocean, v. 10, Fishes, p. 339, 1858.

\* It is not meant, by the use of the words prefrontals and postfrontals, to imply that the bones so called in fishes are the same as those of the same name in reptiles. Indeed, there appear to be few (and possibly no) bones precisely homologous in reptiles and fishes, homoplasy (in the word of Ray Lankester) prevailing rather than homology. But the homonymous bones cover corresponding regions and there is apparently no reason why their modifications are not of approximately equal value in the two cases.

† The *Pygopodidæ* have "the præ- and postfrontals in contact, separating the frontal from the orbit." (B., o. c., v. 1, p. 239). "The structure of the skull is most similar to that of Geckos, but differs in two points: (1) the separation of the frontal from the orbit by the union of the præ- and postfrontal, a character which is shared by *Heloderma*; (2) the reduction of the number of bones in the mandible, in which respect they resemble the snakes." (B., o. c., p. 239.)

‡ The *Anniellidæ* are said to have the "præ- and postorbital in contact, separating the frontal from the border of the orbit." (B., o. c., v. 2, p. 299.)

§ The *Helodermatidæ* have the "præ- and postfrontals in contact, separating the frontal from the orbit." (B., o. c., v. 2, p. 301.)

|| *Osteodia* = *Gymnodontes* + *Ostracodermi*.

- < *Physogastroidei* *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xiv, 1859.  
 < *Sphérosomes* *Hollard*, Annales des Sci. Nat. (4), t. 8, p. 326, 1860.  
 < *Tetraodontoides* *Bleeker*, Atlas Ich. des Indes Néerland, t. 5, p. 45, 1865; Nederl. Tijdschr. Dierk., v. 3, p. 17, 1866.  
 < *Gymnodontes* *Günther*, Cat. Fish. B. M., v. 8, p. 269, 1870.  
 = *Tetrodontidæ* *Cope*, Proc. Am. Assoc. Adv. Sci., v. 20, p. 340, 1872.  
 < *Tetrodontidæ* *Gill*, Arrangement Fam. of Fishes, p. 1, 1872.  
 = *Tetrodotes* *Fitzinger*, Sitzungsber. K. Akad. der Wissensch. (Wien), B. 67, I. Abth., p. 47, 1873.  
 < *Tetrodontidæ* *Jordan and Gilbert*, Syn. Fishes N. Am., pp. 853–859, 1883.  
 = *Tetraodontidæ* *Jordan and Edwards*, Proc. U. S. Nat. Mus., v. 9, p. 230, 1886.

*Synonyms as subfamily names.*

- < *Odopsia*\* *Rafinesque*, Anal. de la Nat., p. 89, 1815.  
 × *Orbidia*† *Rafinesque*, Anal. de la Nat., p. 89, 1815.  
 < *Tetraodontini*, *Bonaparte*, Nuovi Annali delle Sci. Nat., t. 2, p. 131, 1838; t. 4, p. 186, 1840.  
 < *Tetraodina*, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 2, pp. 194, 328, 1839.  
 = *Tetrodontiformes*, *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xiv, 1859.  
 = *Tetrodoniens*, *Hollard*, Annales des Sci. Nat. (4), t. 8, p. 327, 1860.  
 = *Tetraodontiformes*, *Bleeker*, Atlas Ichthyol. Indes Orient. Néerland., v. 5, p. 49, 1865; Nederl. Tijdschr. Dierk., v. 3, p. 18, 1866.  
 < *Tetrodontina*, *Günther*, Cat. Fishes Brit. Mus., v. 8, pp. 269, 270, 1870.  
 = *Tetrodentina*, *Jordan and Gilbert*, Syn. Fishes N. Am., p. 859, 1883.

*Diagnosis.*

Gymnodontes without either pelvis or ribs,‡ with a normally developed caudal region,§ with the intermaxillary and dentary bones severally connected by suture at middle, the supramaxillaries curved outwards behind the intermaxillaries, the ethmoid more or less projecting in front of the frontals, and the postfrontals extended outwards as far at least as the frontals.||

SYNOPSIS OF FAMILIES.

1. Vertebrae numerous, i. e., 12+17 pm. .... *Chonerhinidæ*.
2. Vertebrae few, i. e., 7—8+8—13.
  - a. Medifrontines separated from the supraoccipital by the postfrontals meeting in the middle .... *Canthigasteridæ*.
  - b. Medifrontines articulated with the supraoccipital and the postfrontals confined to the sides .... *Tetraodontidæ*.

TETRAODONTIDÆ.

*Diagnosis.*

Tetraodontoidea with the medifrontines articulated with the supraoccipital and the sphenotics (postfrontals) confined to the sides, the pros-

\* *Odopsia*=*Gymnodontes*.

† *Orbidia*=*Orbidus* (= *Spheroides*) + *Oonidus* (= *Ovoide* Lac.)

‡ The *Triodontoidea* have ribs.

§ The *Moleidea* have an aborted and excessively modified posterior region.

|| The *Diodontoidea* are distinguished by the union of the jaw bones of the opposite sides, and great modifications of the cranium.

ethmoid little prominent to view above and short or narrow, the vertebræ in small number (7, 8+9—13), the head (typically) wide and with a heavy wide snout, and the dorsal and anal fins short and pauciradiate.

#### CANTHIGASTERIDÆ.

##### *Diagnosis.*

Tetraodontoidea with the medifrontines separated from the supraoccipatine by the intervention of the sphenotics, which are connected together and laterally expanded but short, the prosethmoid prominent above, enlarged and narrowed forwards, the vertebræ in normal number (about 8+9), the head compressed and with a projecting attenuated snout, and the dorsal and anal fins short and pauciradiate.

#### CHONERHINIDÆ.

##### *Diagnosis.*

Tetraodontoidea with the medifrontines separated from the supraoccipatine by the intervention of the sphenotics (postfrontals), which are much enlarged and assume a quadrangular form, the prosethmoid little prominent to view and very short, the vertebræ in increased number (12+17), the head wide and with a blunt wide snout, and the dorsal and anal fins long and multiradiate (D 32-38; A 28-32).

#### VI.

The genera of *Tetraodontoidea* certainly very much needs revision, and many species yet require to be referred to their proper systematic places. The paucity of the material in the National Museum prevents my undertaking the task at present. Mr. Barton Bean, the assistant curator of fishes, to whom I am indebted for efforts to bring together the material, has only been enabled to find thirty-three species. There are skeletons of twelve species, viz.:

#### TETRAODONTIDÆ.

##### TETRAODONTINÆ.

1. SPHEROIDES MACULATUS = *Tetraodon hispidus* var. *maculatus* Schn.
2. SPHEROIDES TESTUDINEUS = *Tetraodon testudineus* Linn. = *Stenometopus testudineus* Bib.
3. SPHEROIDES POLITUS = *Tetraodon politus* Girard.
4. AMBLYRHYNCHOTUS PARDALIS = *Tetraodon pardalis*, T. & S.
5. AMBLYRHYNCHOTUS OBLONGUS = *Tetraodon oblongus* Black = *Amblyrhynchotus oblongus* Bib.
6. AMBLYRHYNCHOTUS HONCKENII = *Tetraodon Honckenii* Black = *Amblyrhynchotus Honckenii* Bib.
7. LAGOCEPHALUS LEVIGATUS = *Tetraodon latigatus* L. = *Promecocephalus levigatus* Bib.
8. LAGOCEPHALUS LUNARIS = *Tetrodon lunaris* Schn.
9. AROTHRON MELEAGRIS = *Tetraodon meleagris* Lac. = *Dilobomycter meleagris* Bib.
10. AROTHRON HISPIDUS = *Tetraodon hispidus* Bl. = *Dilobomycter hispidus* Bib.

## COLOMESINÆ.

11. *COLOMESUS PSITTACUS* = *Tetraodon psittacus*, Schn. = *Batrachops psittacus* Bib.

## CANTHIGASTERIDÆ

12. *CANTHIGASTER PUNCTATISSIMUS* = *Tetrodon punctatissimus* Gthr.

My knowledge of the cranial characters of *Chonerhinus* is derived solely from the description and figures of Hollard. There is only one specimen of *C. naritus* in alcohol in the National Museum.

Any additional material will be welcomed and equivalents given in exchanges by the National Museum.

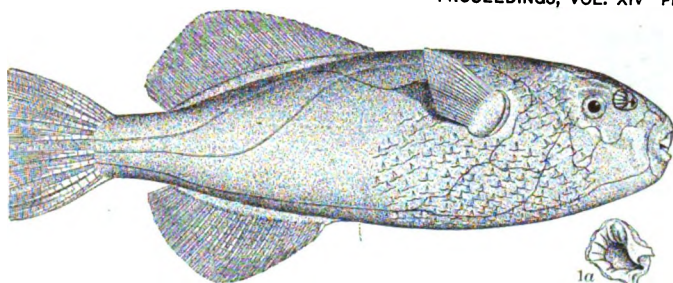
The value of the skeleton, even for specific distinctions, is well illustrated in the case of *S. testudineus* and *S. politus*. Messrs. Jordan and Edwards record the *S. politus* as a "doubtful species," probably the adult form of *S. testudineus*.<sup>\*</sup> They also state that the old specimens of *T. politus* "differ from *S. testudineus* (*annulatus*) only, so far as we can see, in the absence of prickles,"<sup>†</sup> and consequently "see little reason to doubt that *Spheroides politus* is simply the adult of *S. testudineus annulatus*."

The National Museum has skeletons of *S. testudineus* and *S. politus* of nearly the same length, and the differences between the crania of the two is very marked, the former having the interorbital area comparatively narrow, and the prefrontal grooves narrow, while the latter has the interorbital area very broad and the prefrontal grooves shallow and wider <sup>‡</sup>

<sup>\*</sup> Proc. U. S. Nat. Mus., v. 9, p. 247.

<sup>†</sup> Proc. U. S. Nat. Mus., v. 9, p. 239.

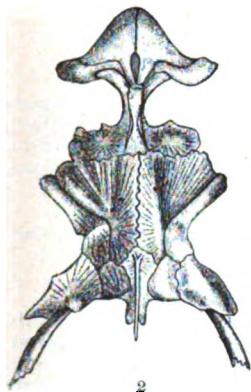
<sup>‡</sup> Profs. Evermann and Barton have reached the same conclusion respecting *S. politus* and *S. testudineus* and have remarked that "the interorbital space is flat" in *S. politus* and "concave in *S. testudineus annulatus*." (Proc. U. S. Nat. Mus., v. 14, p. 165, 1891.) No one, however, has noticed the difference in the width of the interorbital space. It will be interesting to compare the anatomy of *S. testudineus* (typical) and *S. testudineus annulatus*.



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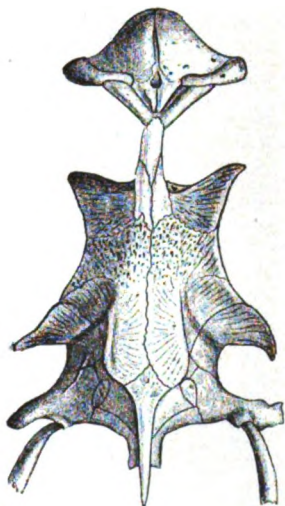
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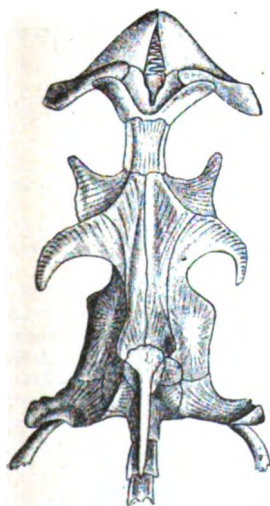
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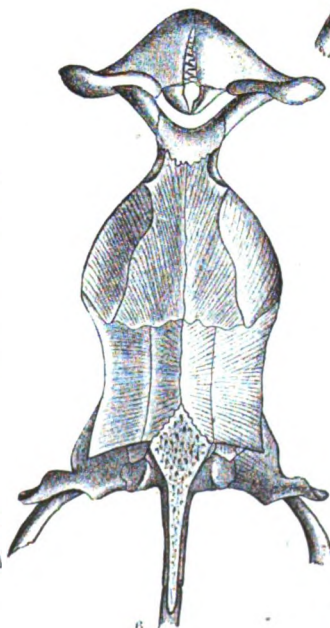
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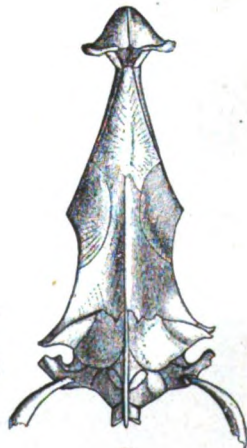
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7

1. *Chonerhinus naritus*.
- 1a. *Chonerhinus naritus* nostril.
2. *Tetraodon*.
3. *Leiodon* or *Monotreta*.

4. *Arothron* or *Dilobomycter*.
5. *Colomesus*.
6. *Chonerhinus*.
7. *Canthigaster*.

The illustrations of crania are reproduced from those of Hollard's memoir.



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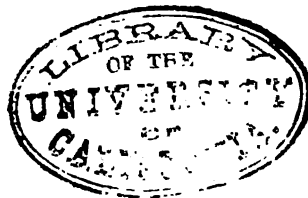
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